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OCTOBER 1 1961

Letters from Readers

KITSETS OR DO-IT-YOURSELF

Sir,

I have read with interest the construction articles in Radio and Electrical Review.

As I am interested in getting the very best for as little as possible, I question the usefulness of buying parts and assembling units from scratch when one can buy a similar unit in kit form plus the chances of getting a much more successful piece of equipment. From a practical view such articles are quite useless except as purely and strictly reading matter.

P. T. BULLEN.
Wellington.

This type of article is dedicated to the man who wants to do it himself, who doesn't get quite the same satisfaction out of building a kit and following instructions—the constructor who wants to modify and adapt, the man who wants to try new things. What do other readers think? —Ed.

BOB'S SERVICE SHOP

Sir,

I would like to express my appreciation of the article Bob's Service Shop currently appearing in R. and E.

As a servicemen myself I can appreciate those stories having had rather similar experiences in dealing with the public. In spite of the fact that radios have long since become "part of the furniture," it still doesn't prevent people from being extremely gullible when it comes to electronic equipment.

I liked the story of the Green Ray Health Box and look forward to many more laughs. Servicemen need them, sometimes, to keep sane.

SERVICEMAN.
Auckland.

Question Box

(Answers to correspondents)

MR. S. LEONARD TAYLOR:

Regarding your query in July R. and E. concerning Electrolytic Capacitors, we hope that the following will be of help:—

The outstanding feature of the electrolytic capacitor is the large capacitance which can be obtained in a given volume, particularly at lower operating voltages. This large capacitance is produced because the dielectric is formal on the surface of the positive electrode, usually aluminium and consists of an extremely thin oxide film, the thickness of the film being proportionate to the voltage used in forming the film; the capacitance which is inversely proportionate to the thickness of the film will also be inversely proportionate to the applied voltage producing the film, and therefore unlike condensers with solid dielectrics, such as paper, whose capacity varies little with applied voltage up to the recommended maximum.

A further interesting point applies to electrolytics using etched foils to increase the surface area of the electrodes. The increase in capacity in this way is also affected by the applied voltage because with lower voltages the oxide film is so thin that it readily follows the contours of the etched surface, and the electrolytic which is the other electrode is semi-liquid and therefore able to follow the contours of the etching and make contact over the whole area. At higher voltages the thicker oxide film bridges the small gaps or valleys, thereby reducing the surface area and consequently the capacity.

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Contents:

Rolling Back The Horizons . . .

Some time ago we examined the number of licensed amateurs per 1,000 population in the Commonwealth countries and the United States of America. We were rather surprised to discover that New Zealand has one of the highest ratios of amateurs to population in any country in the World. It seems, however, that this ratio is not evident in the occupancy of the amateur allocation above 30 megacycles, which at the present time has not exhibited any marked increase in interest or occupancy over that of five years ago. This has not been the case overseas however.

At the conclusion of World War 2, the large amount of surplus equipment available locally provided the impetus for activity in the six and two metre bands. With this "new" equipment the range of Very High Frequency Communication increased by leaps and bounds.

Better antennae, more stable converters, and more transmitter power seemed to be the order of the day in the early 50's. However, V.H.F. was still in the doldrums, and it was not until the period of the International Geophysical Year that V.H.F. really came into its own. Round the world DX. on 50 mc/s was now the rule rather than the exception, with many paths as good as on 10 metres. As many as a dozen countries were contacted from New Zealand and "Worked All Continents" became a real possibility, with a number of Northern Hemisphere amateurs being successful.

On the higher frequencies great advances were made. California to Hawaii was worked first on 144 mc/s, then 220 mc/s, and again on 420 mc/s. The two men who accomplished this were awarded the highly coveted "Edison Award" for their work.

In 1958 the first moon reflection work was done at Jodrell Bank, Ionospheric scatter and meteor trail reflection circuits were commonplace and space communication and telemetering circuits became important with the impact of Sputnik I.

In aviation, on the sea and on the land, both for military and commercial purposes V.H.F. was called upon increasingly to play its part.

Nowadays we have V.H.F. and U.H.F. T.V. an everyday affair, microwave links carrying hundreds of conversations, crystal controlled radar transmitters with peak powers measured in megawatts and ranges of hundreds of miles, and earth-moon-earth communication circuits and reflection from other satellites a commonplace. V.H.F. has matured to adult status and portends a future brighter than any other communication medium, with parametric amplifiers, masers, horn and parabolic antennae being some of the new tools for the V.H.F. man.

Hams overseas have played their part in this surge of development with the latest and most ambitious project to date—an amateur satellite—now well under way. Already the radio equipment in this satellite, called "Project Oscar," has been tested by towing the equipment at varying altitudes with an aircraft. Admittedly amateurs in this country have been handicapped due to the general lack of modern components, but this problem is not insurmountable. What we lack in equipment could at least be made up for in enthusiasm. It is now up to the amateurs of New Zealand to show their friends in other countries that they too can make use of their ability in utilising this now highly prized and useful region of the radio spectrum and play their part in "Rolling back the Horizons."

—I.H.S.

IN June 1959 this Magazine carried an article entitled "Nuvistor—the New Look in Electron Tubes." At the commencement of that article the following introduction was written —"One might almost be excused for believing that the tremendous development in transistors has brought to a standstill the further development of conventional electron tubes but as this article shows, nothing could be further from the truth."

A TWO METRE CONVERTER USING THE NEW NUVISTOR TRIODE

By IRVING H. SPACKMAN, A.M.I.R.E., ZL1MO.

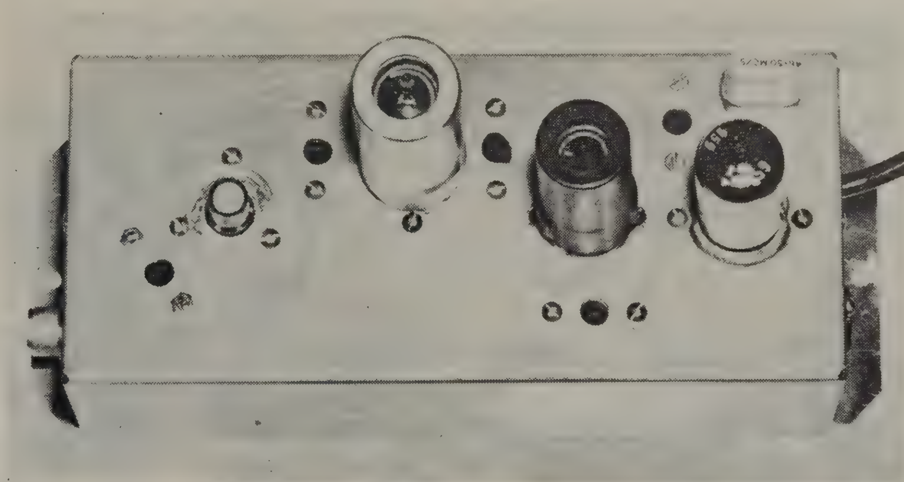
The title "Nuvistor" has been coined by the Radio Corporation of America to cover quite a startling new development in the manufacture of Radio Valves.

Development of the "Nuvistor" series proceeded steadily with advance information being released about the first small general purpose triode under the number 7586. The next tangible evidence of these tubes was in the middle of 1960 when we received information that the 6CW4 Nuvistor Triode was being produced in production quantities for use as an R.F. stage in high performance T.V. Tuners. In the U.S.A. there were several articles published describing the use of the 6CW4 as an R.F. pre-amplifier. About this time we also found that the 6CW4 was to become available in this country, so a pair of these tubes were procured for experimental use.

The 6CW4 appeared to be ideal for V.H.F. converter use for the following reasons:—

1. The tube was physically small, thereby ensuring short leads and small socket contacts. —essential for V.H.F. use.

2. The tube operated without any cathode bias, thus allowing the cathode to be directly earthed; a good feature. The bias was provided by a grid resistor. This also served as protection for the tube in the presence of strong R.F. fields.



Top view of chassis layout. The Nuvistor triode can be seen left centre and the crystal at top right.

3. The tube had small interelectrode capacities, thereby permitting good L/C ratios to be achieved in the interests of high gain.

4. The mutual conductance of 12.5 mA/V was attained at the relatively low plate voltage of 70 volts and 8.5 mA plate current. Thus the tube appeared on paper anyway, to be inherently quiet.

At the beginning of this year, overseas journals described equipment using the 6CW4 and evaluated its performance against other tubes, whilst in England, several firms specialising in V.H.F. equipment commenced manufacturing R.F. preamplifiers and converters using the tubes, so it appeared that this tube now warranted further attention.

The converter described here is, with the exception of the 6CW4 R.F. stage, identical in design and construction to a similar one built some months ago and using as the first R.F. tube a 6J4, in the grounded grid configuration. This was the final product of a number of previous converters using a wide range of V.H.F. R.F. amplifier tubes in a variety of different circuits.

With the exception of the planar type triodes such as the 416A and the very high slope conventional triodes such as the 417A, virtually every tube that the author could locate locally that was suitable for V.H.F. R.F. use was tried and tested.

It was against this 6J4 grounded grid R.F. stage that the new tube was to be tried, side by side under as near identical conditions as were practicable. The existing converter had performed well, receiving signals from as far away as 240 miles under average conditions. The noise figure had been measured and found to be close to 4db. The performance of the new converter will be discussed later in the article.

Construction of the Converter

Any person wanting to build this converter will find that with the exception of the crystal, all other parts are available through

most radio parts suppliers. The crystal used was one of a number purchased in England on the surplus market and still currently available. Although not giving as high an image ratio as desired the image is 40 db down and adequate for the purpose, as the coils in the converter are high Q and tune sharply. Also the I.F. frequency produced fell in a convenient range on the author's communication receiver.

Should another crystal frequency be available or desirable, however, this will not detract in any way from the performance of the converter providing the final mixing frequency is at least 5 mc/s from the 2 metre band. It is believed that both 65.0 mc/s and 43.33 mc/s overtone crystals are available in Auckland and these will operate in the same circuit requiring only a different crystal socket.

The converter, as can be seen in the photo was built on a small 7in. x 3in. x 2in. aluminium chassis, also available through most parts distributors. On one end which we will call the front is mounted the coaxial socket to take the antenna lead. This can also be changed if desired to suit other equipment in use. The type used has been found very satisfactory for V.H.F. use.

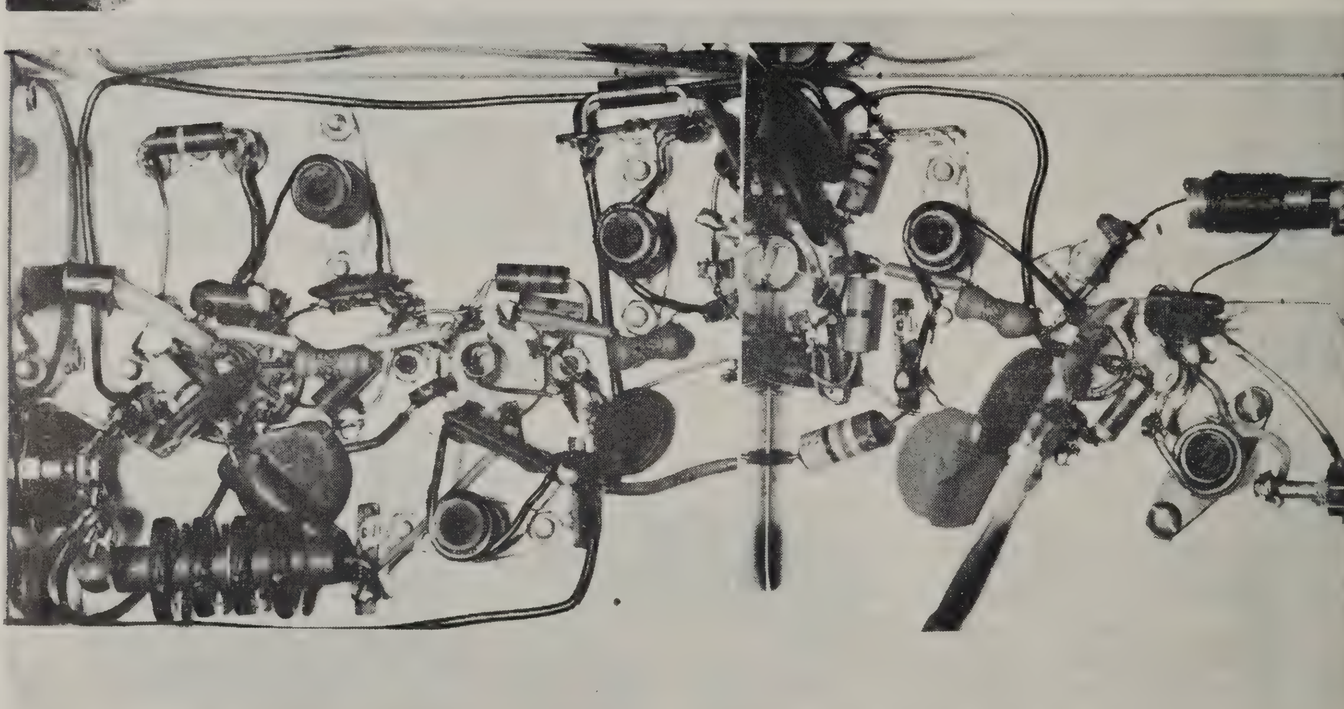
On the other end a 4 pin speaker type socket and plug assembly, for connection to the power supply and a ¼in. grommet to take the coaxial cable to the receiver are mounted. The coil formers and valve sockets are mounted with 8 BA. nuts and bolts. Small paxolin tag panels are used wherever necessary to support the cold ends of coils and other R.F. circuits, also the ends of resistors, etc.

The ECC85/6BQ7 2nd R.F. stage and the 6J6 mixer both use ceramic sockets. The Nuvistor socket used is the special "Cinch" socket supplied with the tube. This socket is mounted by soldering it on to a piece of 20 G copper sheet about 1¼in. in diameter with a hole to pass the socket in the centre and then this is mounted on the under side of the chassis through a ⅝in. hole punched in the aluminium chassis. This copper sheet is mounted securely with three 6 B.A. bolts and nuts and all earth returns are made by soldering direct to the copper plate.

All by-pass condensers particularly in the R.F. stages, are used with practically no external lead length, being mounted straight from the socket to the earth point.

All earth returns associated with each tube should be returned to one main earth point near that tube socket, wherever possible.

The cross socket shields are made of thin tin plate which easily solders into place. The shield across the 6CW4 socket earth the cathode and one filament pin. The shield across the ECC85/6BQ7A socket is cut away to clear the centre spigot of the socket and is earthed to the filament pin, the centre spigot and solder lugs either side of the socket.



View of under chassis wiring and layout.

Where capacitive coupling is used between stages and from the coaxial plug to the antenna coil, use direct earth wires preferably of 20 G or heavier. Do not rely on the chassis to provide the earth returns other than for filament and H.T. negative lines. All coils are mounted so that the hot side

of the coil is mounted directly on the respective tube socket pins, with the cold end bypassed directly back to the tube socket. Decoupling resistors are used in all R.F. amplifier circuits.

The mixer stage is operated with low plate voltage and a high value of grid leak. A 2.5 mh R.F.C. is used as a plate load together with the voltage dropping resistor. There is no need for additional oscillator injection into the mixer section because there is sufficient coupling across the common cathode lead inductance of the 6J6. The mixer is coupled to the cathode follower which uses half of the 12AT7/ECC81.

It is good practice to keep all R.F. leads short in the oscillator section as well as to achieve best efficiency in the multiplier section.

If a different oscillator frequency is used, some experimentation may be needed in the oscillator coil and multiplier anode circuits.

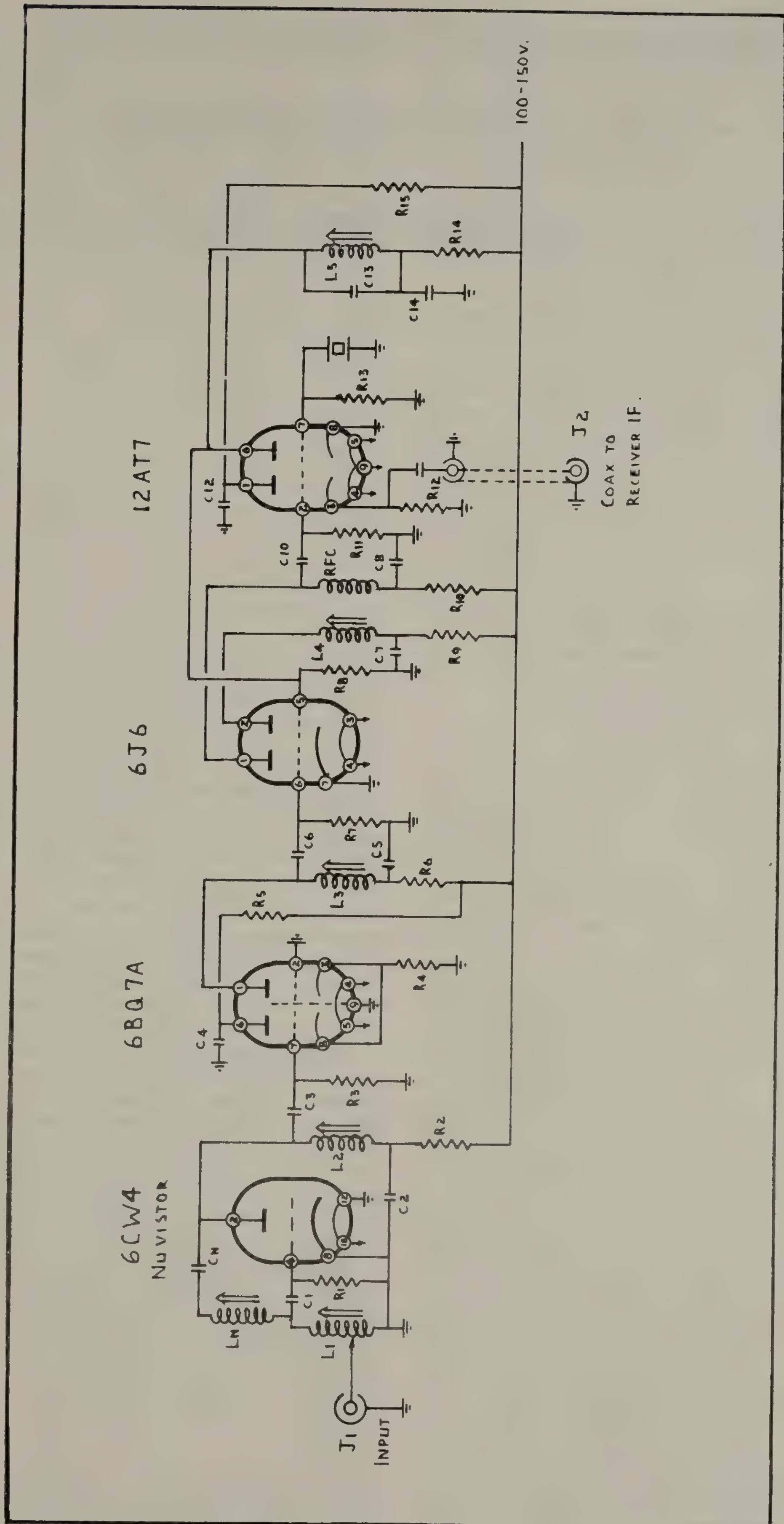
The signal to the receiver is fed through a piece of 70 ohm coaxial cable. If there is any trouble from pickup of stray signals on the I.F. frequency, a flat aluminium plate can be fixed to the bottom of the chassis with only slight readjustment to the tuning of the coils.

Care should be taken when soldering the coils in place. If too much heat is used this will travel up the heavy wire, and tend to melt or distort the polystyrene coil formers. It would be wise in any case to use a pair of thin nosed pliers as a heat sink and grip the wire between the joint and the former.

All the coils with the exception of the neutralising coil and the oscillator plate coil are quite self supporting, and do not require doping to hold them in place. They are wound on a drill shank very slightly smaller in diameter than the coil former and slid on to the formers after these have been bolted in place. The other two coils are wound and then doped with polystyrene dope to prevent any possible movement of the finer gauge wire.

Preliminary Setting Up

The coils can firstly be aligned



close to the desired frequencies with a grid dip oscillator if available. A source of 6.3v at about 1½ amperes and high tension 125 to 150 volts at 30 m.a. or so is suitable, or this can be taken from the associated receiver if the extra capacity is available. It is suggested that the voltage be regulated by a voltage regulator tube to achieve the stability necessary to copy S.S.B. on 2 metres. Otherwise this is not really necessary, but is an insurance against overloading the 6CW4 "Nuvistor" which must not have a higher plate input than 1 watt at any time. It is recommended that the input to the 6CW4 anode be kept below ¾ watt for optimum performance. The maximum anode voltage is 70 volts and the anode dropping resistor must be selected to maintain this value. The tube will operate well with anode voltages down to 40 volts but best gain and noise figure is obtained when the rated plate voltage and current are maintained.

Adjustment

The first section to check is the oscillator. The type of oscillator is such that oscillation will only occur when the plate circuit is tuned higher in frequency than the crystal working frequency. The oscillator can be checked either by listening in a receiver tuned to 46.5 mc/s or other crystal frequency in use, or with a sensitive wavemeter or field strength meter tuned to the crystal frequency and loosely coupled to the oscillator coil. Another way to check oscillator operation is to measure the negative voltage at the grid of the multiplier with a 20,000 ohm volt meter or V.T.V.M. If the 20,000 ohm/volt meter is used then connect a 20k or higher value resistor to the probe and use this as a low capacity connection. It will be observed that as the slug is screwed into the coil output will rise to a maximum and then cease. The correct operating point is backed off a little from the maximum point. This will ensure stable operation end reliable starting.

Once the oscillator has been checked the converter can be coupled into the receiver and the receiver tuned to the correct I.F. range; in this case 4.5 mc/s. Signals from a signal generator or harmonics from a crystal oscillator, or V.F.O., or from a transistorised crystal spotter such as that described previously in this magazine should be coupled into the mixer grid coil, and the receiver tuned to the correct frequency, whereupon the signal should be heard. If a signal generator is used it should be coupled to the coil with a small 1 turn loop of wire connected across the end of the leads.

The multiplier plate circuit should then be touched up to give maximum signal strength in the receiver. This completes the oscillator alignment. Now move the test oscillator connection to the grid of the second R.F. amplifier. If harmonics are being picked up from an external V.F.O. or other source, reduce their amplitude if possible. Now align the mixer grid coil for maximum signals.

Now go over the multiplier and mixer tuning again to give a second touch up. The converter should be sounding quite lively and giving a very strong signal in the associated receiver.

The next point is to connect the antenna or a very well shielded oscillator to the converter input socket. If an antenna is used one should look for a strong signal from a local station on 2 metres. If the signal generator is used this should have the signal increased until a good strength signal is heard in the receiver again. This signal should now be coming through the R.F. stage by virtue of the grid-plate capacity of the 6CW4 only. Now peak up the signal by adjustment of the slub in the aerial coil of the R.F. stage and also re-check the tuning of the 6CW4 plate coil. When these are aligned then carefully adjust the slug in the neutralising coil LN for minimum signal. This will be a very sharp null so tune slowly to avoid missing it.

Once the R.F. stage is neutralised then connect the plate feed resistor for the 6CW4 onto the high voltage tie point (Caution—High Voltage). The signal should increase at least 25 db or more in strength, that is, 4 to 5 "S" Points. Adjust the aerial coil, 6CW4 plate coil, mixer grid coil, and multiplier plate coil for maximum signal.

Now disconnect the signal generator and connect the antenna. Tune to a signal in the middle of the desired frequency range. Because of the high Q circuits used in this converter the maximum frequency coverage without appreciable falling off in performance is about 1 megacycle. Generally speaking most activity is in the region 144 to 145 mc/s so tune to a signal near the middle of this tuning range. Alogn all the circuits for maximum sensitivity on this frequency.. Now disconnect the plate voltage to the 6CW4, reconnect the signal generator and check the neutralising coil adjustment for minimum signal. Once this is done, connect the antenna and the Nuvistor plate supply and you have a first-class converter working for you. This procedure will be close to the best you can do unless you have a noise generator but you can get a slight improvement by adjusting the grid circuit, for maximum change, with respect to noise when a very weak signal is tuned in. The position of the tap on the antenna coil may require adjustment for absolute top performformance but any difference this might make will be difficult to observe unless you are set up to measure noise figures. The best noise figure will generally be obtained with the aerial coil tuned slightly lower in frequency (slug into coil) than the setting which gives maximum gain.

Evaluation of the New Converter

Noise figure and signal to noise measurements seemed to indicate that the new 6CW4 converter is about 1-2 db better than the existing converter, that is about 2-3 db. This is getting down into the region where equipment irregularities show up and also absolute noise figures are very difficult to measure. The gain of the

(Continued on Page 28)

electronic control and indication of level and proximity

by C. W. SALMON.

FOURTH AND FINAL PART.

IN previous articles we have discussed instruments embodying means of detecting fairly large changes of capacity, perhaps in the order of hundreds of pfds. Usually these changes have been brought about by the intrusion about the electrode of a large mass of material such as oil or coal which has made intimate contact with the electrode probe. All the previous methods discussed have depended upon this close contact between the material and the probe and this can be said to be perhaps the only major disadvantage of this method of control and indication. Either the plain controller or the level indicated cannot very well be used to detect or measure a change of even one uuF in a standing capacity of, say, 100 pfds.

Described below are instruments capable of measuring very small variables but still based on a change of capacity. Whilst the instruments are more complicated than the units described earlier they still have, considering their adaptability, reasonably simple circuitry.

Proximity Meter

The English firm of Fielden have produced a type PM2 meter to measure capacity and capacity changes by proximity rather than actual contact. The application of the instrument depends upon the measurement of the capacitance change in most situations brought about by a small mechanical displacement. By ingenuity in the arrangement of the electrode it is possible to apply this method to a wide range of problems, particularly as it is capable of both static and dynamic measurements.

The sensitivity of the PM2 instrument under discussion is usually greater than the mechanical stability of the equipment under investigation.

A mechanical movement of less than .00001" can be detected quite readily. Another advantage is that as there is no physical contact with the material under investigation no damage due to contact pressure, wear or corrosion will occur.

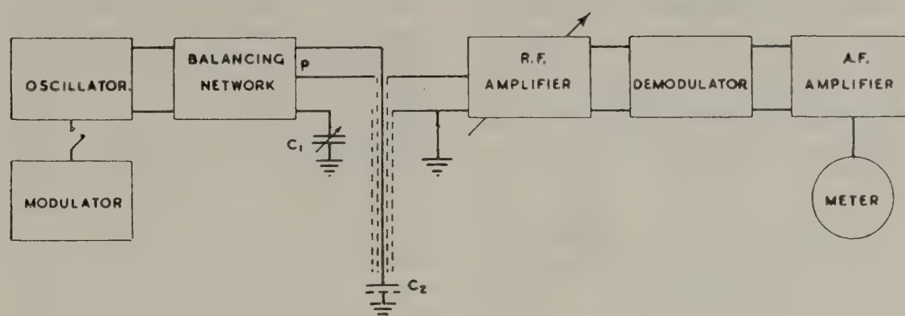


Fig. 1: Schematic arrangement of the Fielden proximity meter.

Brief Technical Description

An oscillator (Fig. 1) at 500 kc/s supplies a small R.F. voltage to a capacity balancing network, which is so designed that its output consists of two earth-free, equal and anti-phase voltages joined in series at point P. One side of this circuit is connected to earth via the internal variable capacitor C.1. (balance control), and the other side is fed to earth via C.2., this being the capacity at the termination of the R.F. cable. When C.1. is adjusted to equal C.2., the voltage at the centre point P is zero and the output of the instrument is also zero. Any asymmetry in the values of C.1. and C.2. results in an "out of balance" voltage at the input to the amplifier and in a consequent deflection of the meter.

The R.F. cable is constructed with an intermediate screen which is so connected as to minimise the effect on the measuring circuit of stray capacitances. It is thus unnecessary for the instrument to be at the actual measuring point.

The instrument is provided with a modulator which can be switched in or out at will, and this is used to modulate the R.F. voltage from the oscillator with a 3 kc/s sine wave. This modulator is used whenever the instrument is employed for measuring slowly varying quantities or for static sampling.

In addition to the capacitances shown in the schematic diagram, a further variable condenser is incorporated in the bridge circuit as a fine balance control. A resistive balance is also provided so that any necessary power factor corrections can be applied in order to balance the instrument correctly to zero.

The information can be taken from the indicating instrument on the front panel, or from terminals which are provided, or used with a cathode ray oscilloscope or chart recorder. The standard model is suitable for use with the Fielden Servograph Recorder, or any one-milliamp recorder. A special model PMK2, with modified output circuit is available for use with the Kelvin-Hughes High Speed Recorder. The instrument is provided with a modulator which can be switched in or out at will, and is therefore suitable for measuring static, slowly varying or rapidly varying quantities.

Some Applications of the Proximity Meter

Bearing in mind that it only needs movement between two objects (to provide the required signal to the unit) relative displacements are just as easily handled and this gives the instrument a wide field of applications in structure deformations tests.

The application of resistance strain gauges to a variety of work in the automotive and structural field is well known but with a capacity gauge the condenser head arrangement can consist of two simple metal brackets bolted or cemented to the specimen, one of these brackets carrying the proximity meter electrode as shown in Fig. 2. There is no need to earth the other bracket as the capacity connection via the fixing cement will be quite effective on metal structures and the bracket itself will have sufficient self capacitance to operate satisfactorily where the structure under examination is made from non-conducting materials, i.e., wood, etc.

For greater sensitivity in measuring longitudinal stress a condenser head of the type shown can be employed.

In this case a metal rod is securely fixed to the structure by a block A and is arranged to be a sliding fit in a further block B. A small disc C is attached to the rod in order to form one plate of the condenser, the other plate being the ring plate D which is attached to the proximity meter cable. The plate D is fixed rigidly to block E but is insulated from it by the insulating washer F. This arrangement gives extremely sensitive results for the examination of relatively small stresses in very large structures.

Where it is desirable to examine strain under dynamic conditions of vibration, etc., the modulation is switched off and the meter reading will then show a deflection proportional to the mean amplitude of strain.

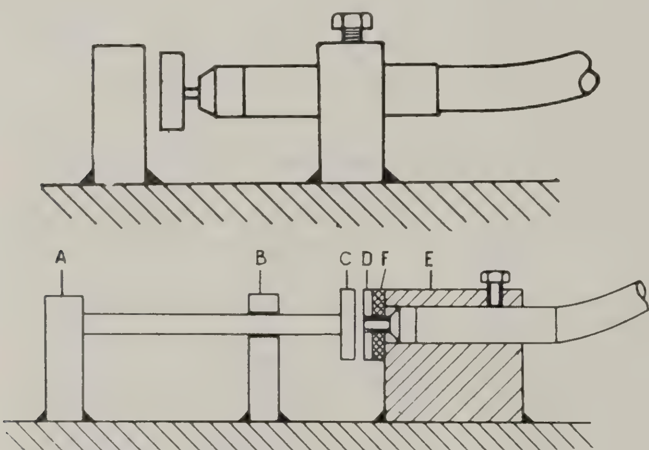


Fig. 2: Top: Simple strain gauge arrangement. Bottom: More sensitive strain gauge set-up.

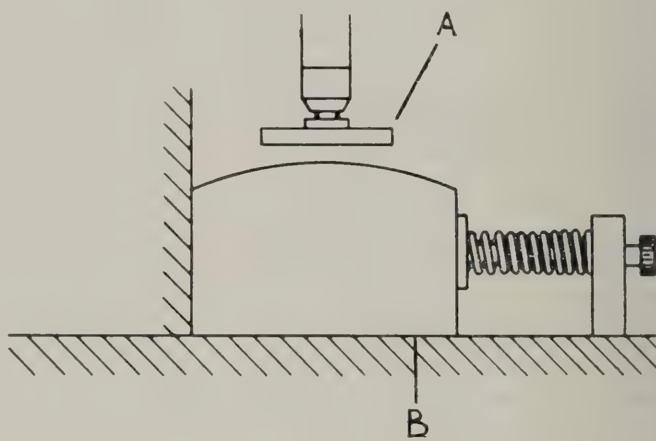


Fig. 4: Proximity gauge used as a micrometer.

As a Concentricity Gauge

The proximity meter has been widely applied in this field. It is particularly useful where the speed of revolution is too high for mechanical micrometer methods to be used, where no mechanical load must be imposed on the object to be measured, where the sensitivity of mechanical methods is insufficient, where there is great difficulty of access for the application of normal mechanical methods or where the physical conditions, e.g. high temperatures and pressures or evacuated spaces, are to severe to permit other methods to be used.

Some typical examples of this application in which the PM2 has been used successfully, are measurements of eccentricity of textile spindles, bobbins, turbine rotors and centring objects on machine tools, etc.

An especially interesting example has been the examination of commutators under running conditions. By displaying the output of the PM2 on an oscilloscope it was possible to study the height of each individual segment.

The application technique in all cases is the same and is shown in Fig. 3. A small rectangular plate electrode A is attached to the proximity meter cable and rigidly supported near to the work B, the size of the gap between the plate and the work depending, of course, upon the sensitivity required. For static measurements the modulator is used and the information is taken from the meter on the front panel. For dynamic measurements, up to any rotational speed, the modulator is switched off and the amplitude of eccentricity is shown as a direct reading on the scale of the meter. Alternatively, the wave form produced can be examined on a cathode ray oscilloscope.

The sensitivity of the PM2 is such that the rotating material need not be a conductor but can be an insulating material as is the case when the instrument is applied to the mass testing of

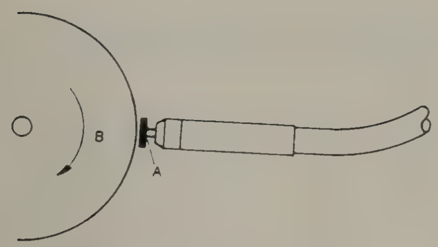


Fig. 3: Concentricity gauge.

high speed wooden perns and bobbins in the textile and similar industries.

It is possible to design probes capable of working at high temperatures by constructing them with low temperature co-efficient materials, e.g. quartz for the insulation and invar for the electrode.

As a Micrometer

Another simple application of the proximity meter is as a micrometer, either for the comparison of very small dimensions in the field of research, or as a rapid and indestructible comparator of small parts in the factory. Its outstanding features are infinite sensitivity and the fact that there is no need to touch the specimen under examination.

The cable is terminated in a small disc plate A which is firmly held at a finite distance from an accurate plane B, as shown in Fig. 4. The specimens on test are accurately located on the plane, beneath the condenser plate, and the deflection of the meter is proportional to the condenser spacing.

A further advantage over the normal type of micrometer is that, since the electrode does not touch the specimens, any inaccuracies due to variations in pressure are completely eliminated.

The above applications are the more usual and readily obvious uses but in addition a Proximity Meter can be used with probe or electrode modification to a number of other applications.

Vibration Meter

Figure 5 shows a set up where the material is vibrating across two plates. The advantage of a capacitive pick up in such an application is that there is no contact between the vibrating object and the measuring device so that this reduces the damping of the vibrating system and in most cases eliminates it all together. The only thing to be taken care of is that the electrode mounting must be vibration free. Non-metallic materials such as cords, plastics and so on can be dealt with provided that the filaments of the material, if they are thin cords by metallising them by the usual method of sputtering. If this is not possible then a two plate condenser can be used and the vibrations arranged so that they take place in the non uniform fringe field. Another method is to shape the capacitor's plates shown in Fig. 5 so that the mass of the material varies with displacement.

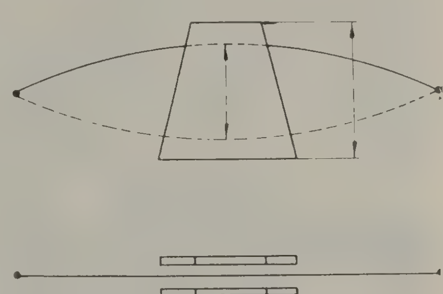


Fig. 5: Vibration meter principle.

For this application the modulation is switched off and the meter shows a deflection proportional to the mean amplitude of the vibration. In addition the waveform of the vibration may be displayed on an oscilloscope.

Two further applications are the use as a paint thickness gauge and as a pressure gauge. Where the Proximity Meter is used as a paint thickness gauge used on shaped surfaces may require shaped electrodes. The use of the Proximity Meter as a pressure gauge would ordinarily not be warranted as a calibration between the pressure plate and displacement would have to be made. However, where it is not possible to fit a conventional gauge or gauge indication the fitting of a diaphragm with a capacitor plate is one way out of the problem.

Where the pressure fluctuates rapidly the Proximity Meter is an ideal instrument. The output from the unit can be fed to an oscilloscope or chart recorder. It is particularly valuable for recording the effects in pressure vessels subject to sharp explosive forces where damping by equipment of more conventional nature would be a problem.

Where it is desired to measure low pressures then a simple method can be used to detect the extension of light bellows.

Using a very flexible and highly stable metallic diaphragm or bellows, with an electrode having a small gap and large area, full scale deflection of the meter for 0.01″ water gauge has been obtained and it is possible by displaying the output on an oscilloscope to observe transients under such conditions.

One application which has been made possible by this extremely high sensitivity is an ingenious and accurate method of measuring the internal diameter of rubber tubing, developed by Dunlop Research Ltd.

One end of the tubing is connected via a tee-piece to a small flexible metallic bellows and to a constant pressure air supply. A steel ball having a small clearance is inserted in the tubing and arranged to be held in one position magnetically as the tubing is drawn over it.

The pressure at the bellows varies with the clearance and therefore, with the internal diameter of the tubing and the pressure is indicated by the PM2.

Capacity Instruments in Textile and Similar Manufacturing

In producing Spun Yarn one of the problems is to maintain a continuous check on the quality of the yarn so blemishes or faults in the constituent fibres fall within required limits. When yarns were first spun their quality was judged by only visual examination and in more recent times

even the same method has been used but in some more sophisticated manners.

The yarn industry has used the black card method for a number of years but this method has several shortcomings, principally that it is confined to a twist product and is not usually used at early manufacturing stages where most of the defects originate. Also the effects are examined over a relatively short piece of material and in certain modes of operation blemishes occurring at regular intervals can be missed altogether. It is difficult with carding to classify the product except in broad definitions, good, normal or bad. Also it is not possible to keep a permanent record and thus no statistical approach can be made.

Dr. Walker, of the Manchester University, published in 1950 details of work in which it was established that the quality of yarn could be determined by passing the material through a capacitor head having a perfectly parallel electrical field.

A capacity meter can thus be adapted to suit the requirements of the Textile Industry and the general details given previously of capacity instruments will make it obvious that the problem is not very difficult.

The yarn is passed through a capacitor assembly having an effective field length of one centimetre. The capacitor forms one arm of a bridge circuit fed from an RF Oscillator. With no material in the capacitor assembly the bridge is zero output.

The introduction of yarn in the capacitor gap causes an out of balance voltage proportional to the mass introduced. The out of balance voltage is suitably amplified and fed to output indicators.

Whilst the presence of moisture will have an effect on the absolute reading usually the gauge is used as a comparator so that any moisture in material that has been stored for some time should be constant throughout its length.

Figure 6 shows a capacitor head suitable for measuring yarn of moderate thicknesses. The standard evenness recorder can be fitted with a number of capacitor assemblies to take yarn from dials of about ½" to the finest yarn not much thicker than sewing cotton. Where measurements are needed during the actual spinning process a hand held electrode can be used.

Measurement of Moisture

A sister instrument to the Yarn Evenness Gauge is the Drimeter used for checking and controlling the moisture content of yarns and fabrics. Used for fabric drying the Drimeter makes it easy to maintain machines at correct speed to deliver fabrics consistently either with its natural or any required moisture content and over drying is prevented and thus improved finishes can be obtained.

As many fabrics come off machine processes hot it is difficult to obtain correct judgment of moisture by hand. The use of electronic Drimeters has prevented over drying and certain installations have had production increases of up to 40%. By using controllers the moisture content can be regulated automatically at the drying stage. Although the Drimeter is is physically different in construction to an Evenness Gauge the same capacitance principal applies. The function of an electronic Drimeter depending upon the fact that the Dielectric Constant of water is very high compared with that of cellulose.

The above series of articles has indicated the scope of measuring both materials and qualitative processes by measurement of change in capacity of the object under observation.

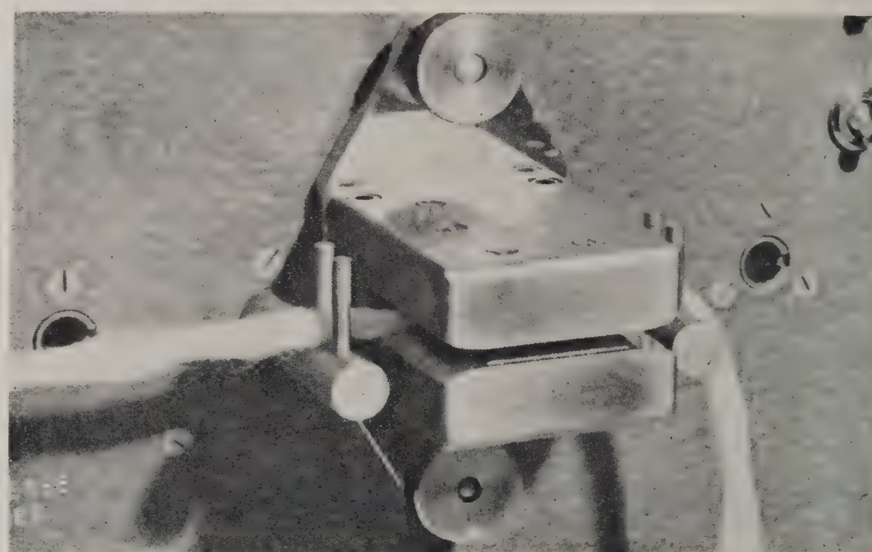


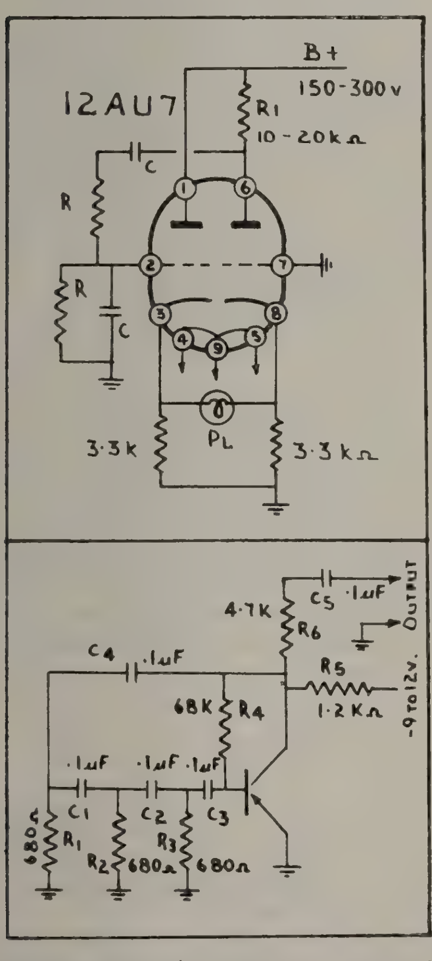
Fig. 6: View of an electrode head for measuring sliver, roving and yarn.

Thus it will be seen that the range of instruments vary from a single valve level controller to an Evenness Gauge having many valves. Nevertheless they all operate on one basic principle. It is hoped that the general outline given will be an incentive to electronic engineers and technicians in this country to consider the possibilities of simple basic circuits.

Thanks are due to Fielden Electronics (Aust.) Pty. Ltd., of Melbourne, and Turnbull & Jones Ltd. for information made available.

Simple Audio Oscillators for the Experimenter and Audio Enthusiast . . .

Quite often one needs a source of good clean sine wave audio for test purposes. These oscillators briefly described are useful for the audio technician for testing amplifiers and lines, the amateur for testing modulators and as a second source of tone for two tone testing of side band equipment. The technician can carry the transistorised equipment around easily, keeping the good audio generator on the bench in the workshop.



(Top)—Fig. 1. Adjust R1 just to verge of oscillation for best waveform. PL—6 watt 110 volt pilot light or equivalent.
(Lower)—Fig. 2. C1, C2, C3, C4, C5—0.1 mfd. R1, R2, R3—680 hms ½w. R4—68k ½w. R5—1.2K ½w.

The first tone oscillator uses a 12AU7/ECC82 type twin triode. This equipment should give a distortion figure considerably better than .5% if the resistors and capacitors are well matched and the value of the plate load resistor is reduced until oscillation is just on the verge of stopping. In many cases such precision is not needed however.

Other tube types such as the 6SN7 or 6CG7 may also be used with no other change than the readjustment of the load resistor. It is suggested that a cathode follower using another similar triode be used to couple into a coaxial cable from the plate of the grounded grid section of the oscillator.

Some typical values of R and C for a selection of different audio frequencies are listed below:—

Frequency	R. (ohms)	C (mfds)
500 c/s	300 K	.001
1000 c/s	150 K	.001
2000 c/s	75 K	.001

For variable frequency use, the two resistances can be the two sections of a ganged ½ megohm potentiometer. The frequency of oscillation is determined by the values of R and C within the limits of 10 K and 10 megohms for the value of R and 100 pf and 1 mfd for C.

The second oscillator is a transistorised phase-shift oscillator which can be useful for running a bridge, or for building into musical instruments. The unit described is reliable, starts easily, produces a good clean sine wave and is reasonably stable with temperature.

The frequency of oscillation is about 1000 c/s with the components as specified. If it is desired to increase the frequency, decrease the value of the phase shift condensers, and vice versa for reduction in frequency. This can only be carried to certain limits, however. The circuit is essentially a four mesh network with voltage feedback from collector to base to provide some stabilisation.

If other transistor types are used with lower orders of current gain there may not be enough gain in the transistor to compensate for the loss in the phase shift network. In this case it will be necessary to take out one R and C section of the phase shift network, with slight degredation of performance.

To get good stability use only good grade condensers and high stability resistors. The whole oscillator can be conveniently built on a piece of pascolin or vero board. If pascolin is used holes can be drilled and eyelets rivetted through the holes to provide suitable soldering and mounting points.

* * *

New Radar Equipment For N.Z. Meteorological Service

The N.Z. Meteorological Service has reported that new windfinding Radar equipment is to be purchased. Wartime equipment at present in use has proved costly to maintain.

The first of the sets is nearly complete and was expected to be ready for engineering inspection and operational tests in England by the end of October. If all goes well it should be shipped to New Zealand shortly and installed at Ohakea by March or April, 1962. Other New Zealand installations will be at Whenuapai, Wellington, Christchurch airport and Invercargill. There will also be one at Nandi, one on Funafuti Island, in the Ellice Islands, and one on Raratonga.

The network—a 10 cm. pulse radar system—will be used for measuring winds and for weather warning in New Zealand and the South Pacific.

Radio and Electrical Review hopes to bring you a full feature story on this new equipment after the installation at Ohakea. B. R. Homersham Ltd., the local representative of the manufacturer, is to do the installation work on a contract basis.

LOOKING AT Transistor Class B Power Output Circuits

Simple design procedure that will help you to understand this very useful and popular transistorised circuitry.

TRANSISTOR audio amplifiers have many advantages over their vacuum tube counterparts, but one circuit that really highlights these advantages is the Class B push-pull power amplifier. The great efficiency and simplicity of transistors really shine in this application. With no filament power requirement and a relatively low "B+" voltage, the power drain during quiet periods is negligible and the over-all circuit efficiency extremely high. These are certainly very desirable features.

In this article a typical 8-watt amplifier design will be illustrated. The same design procedure can be used for amplifiers at other power levels and for different transistor types. Those readers who are more concerned with trouble-shooting transistor audio amplifiers will find the material helpful in understanding the sources of the most frequent defects they are apt to find in transistor circuits.

Class B operation means that each transistor will amplify only one-half of the signal and will "rest" while its partner amplifies the opposite-polarity portion of the signal. Because power dissipation is one of the most critical factors in transistors, Class B operation is particularly suited to the task of insuring low dissipation for each transistor. There are only two drawbacks to this type of transistor circuit (1) crossover distortion and (2) thermal runaway. These will be discussed below.

Crossover distortion occurs when one transistor stops conducting before the other has started and is a typical problem with all Class B circuits. Thermal runaway can occur in any transistor application but power transistors are especially susceptible. This trouble is due to the fact that, as a transistor heats up, it will tend to draw more current which, in turn, will cause the collector to heat up even more until the unit burns out. There are well-established and relatively simple cures for both crossover distortion and thermal runaway and they will be described later in some detail.

Amplifier Design Procedure

In any power amplifier design the governing factors will be the desired power output, available voltage, and component efficiency. Assuming that we wish to be able to deliver 8 watts to the loudspeaker, we must first account for the losses in the output transformer, which may be about 80 per cent efficient. This immediately brings the actual maximum power that the two transistors must deliver up to about 10 watts. If we want to allow for 25 per cent overload capacity the power is increased to 12.5 watts or 6.25 watts per transistor. A typical supply voltage would be 12 volts which would permit operating the equipment direct from a car battery or two 6 volt lantern batteries. It would also be possible to build a well regulated supply, using a 12.6 volt transformer as power source.

Once the power and the voltage are determined, we can select a transistor type. It must be able to handle at least 6.25 watts and must have a collector-to-emitter voltage rating of at least twice the supply voltage, which means 24 volts. For our example we have selected the R.C.A. 2N301 type which is readily available. This transistor is rated at 40 volts collector potential and can dissipate 11 watts at 80°C which means about 25 watts at room temperature. These ratings are higher than our minimum requirements but they afford us a much needed margin of safety.

To get an idea of what the peak-current swing per stage can be, we can calculate:

$$\frac{6.25 \text{ watts} \times 4}{12 \text{ volts}} = 2.1 \text{ amps.}$$

The manufacturers' data shows that the 2N301 can handle up to 3 amps peak current. To get the load resistance per stage we divide the 12-volt supply voltage by the 2.1 amp peak current and this is roughly 6 ohms. One of the characteristics of Class B push-pull circuits is the fact that the total primary impedance of the output transformer is four times the load resistance per stage or 24 ohms in our example.

At this point it is useful to study the characteristic curves of the transistor in question. Fig. 1 shows the collector characteristics for the 2N301 for various values of base current. The a.c. load line for the 6 ohm load resistance is drawn by connecting the 12-volt, zero current point to the 2.1 amp., zero voltage point. To calculate maximum power handling ability we have accounted for 25 per cent overload capacity, but for normal operation the current and voltage swing will be limited by a factor

$$k = \text{square root } \sqrt{\frac{1}{1.25}} = 0.896$$

Therefore, the normal full-load current swing will be only 2.1 amp. x 0.896 = 1.88 amp., as shown by the dotted line in Fig. 1. Another curve, Fig. 2, shows the average transfer characteristic which is simply a graph of collector current v base voltage. For 1.88 amps of collector current, the base voltage will have to be

0.78 volts and this on the base characteristic curve of Fig. 3, will cause a base current of 34 ma. The product of 34 ma x 0.78 volts is the input power, 26.5 mw.

The input impedance per transistor can be found by Ohm's Law from 0.78 volts divided by 34 ma., or 23 ohms. We can now draw a basic diagram of the Class B amplifier with its input and output requirements, as shown in Fig. 4. This simple circuit will, however, suffer from the disadvantages inherent in Class B transistor amplifiers. If we drive this amplifier with a sine-wave signal of maximum amplitude, 0.78 volt peak at the base of each stage, then the output signal at the loudspeaker will have the waveform of Fig. 5A, which shows the typical symptoms of crossover distortion.

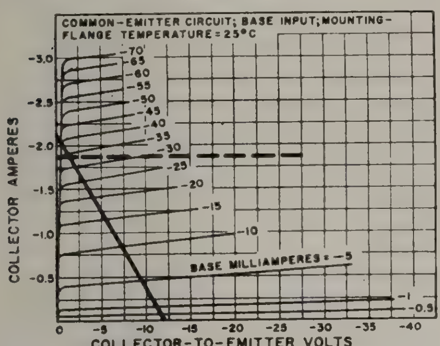


Fig. 1. Collector characteristics of 2N301.

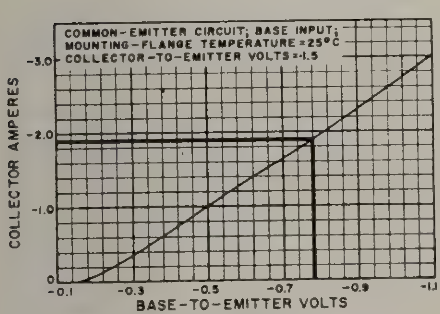


Fig. 2. Transfer characteristics of 2N301.

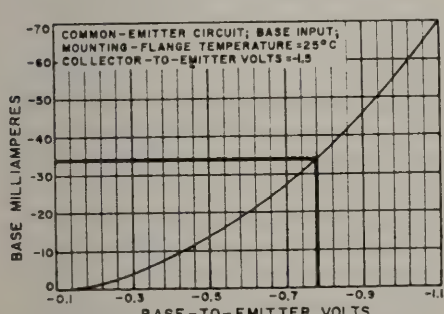


Fig. 3. Base characteristics of the 2N301.

Crossover Distortion

Fig. 5 illustrates one of the most frequent defects in Class B transistor amplifiers and the serviceman working with these circuits will soon become quite familiar with the appearance of these distorted output signals. To understand the cause for crossover distortion we need only look at the average transfer characteristic curve of Fig. 2 and study the lower portion of the curve below 0.2 volt of base bias. Here the curve flattens out and stops completely at 0.13 volts. This means that from about zero to 0.13 volts of base signal, no current flows in the collector circuit. When the base signal is very small the collector signal will take the form of the curve of Fig. 5B, with current flowing only during that portion of the sine wave which corresponds to more than 0.13 volts of base voltage. Since the two push-pull transistors have the same characteristics, the distortion will be balanced about the zero line of the sine-wave signal.

To overcome this trouble it will be necessary to forward bias each transistor slightly. In effect, for small signals, the transistors then operate as Class A amplifiers. This method can completely eliminate crossover distortion but it means that each transistor draws some current at all times and this reduces the efficiency of the Class B stages. In a good design, the forward bias voltage is set carefully to minimise the quiescent collector current.

Returning to the design of Fig. 4 we can see two places where forward bias might be inserted. We could insert an additional battery between ground and the two emitters, or, and this is the simpler approach, we can utilise a portion of the 12 volt collector supply to feed a small negative voltage to the two bases. This will cause a loss in the input signal due to the impedance of the biasing network.

The 2N301 characteristic curves of Figs. 2 and 3 indicate that forward bias of about —0.13 volts is required. Previously we calculated the peak input impedance to be about 23 ohms. The bias resistor should usually be about three times as large so we select a value of 63 ohms, a readily available and standard unit. By using Ohm's Law we find the current through the resistor to be 1.91 ma. At 0.13 volts the base current itself is practically zero so that only about 2 ma. will flow in the bias resistor.

Because of the variations among individual transistors and other circuit constants it is advisable to include a potentiometer in the bias voltage divider and set the actual voltage level for minimum collector current, commensurate with minimum crossover distortion.

Looking at the revised circuit of Fig. 6 we can now see that the input power of 26.5 mw. which we calculated previously will not be sufficient because the actual input impedance, per stage, is not now 23 ohms but a total of 91 ohms. The ratio between the I^2R input power for equal current is simply the ratio of 23 and 91 ohms, which is 3.95. This corresponds to approximately 6 db, the increase in input needed to overcome the effect of the forward-bias network. The input power required to drive the circuit of Fig. 6 for peak output is therefore 105 mw. Accounting for transformer losses of 20 per cent we find that the actual peak driving power delivered by a driver amplifier to the primary of the input transformer will have to be about 135 mw.

Driving circuits for Class B power amplifiers deserve a lengthy article in themselves, but in this limited space we can only point out that Class A single stage amplifiers or Class A push-pull circuits are usually used in this application. There are a number of circuits which avoid the use of a driving transformer and provide phase splitting and impedance matching directly. For the example cited here it would be possible to use a single stage Class A 2N301 as driver. The prime requirement of a driver stage is power handling ability with low distortion.

Thermal Runaway

One of the basic facts about semiconductor physics is the interdependence of current flow and temperature. As the temperature goes up, more current flows. As current flows, heat is generated in the transistor. These two facts impose a severe restriction on the circuit designer, especially when germanium transistors are used where the critical temperatures are relatively close to room temperature. Silicon devices have a somewhat higher critical temperature. The transistor characteristic curves of Figs. 1, 2, and 3 all bear the notation "mounting flange temperature 25°C" and this means that at a higher or lower temperature the characteristics shown may be changed somewhat.

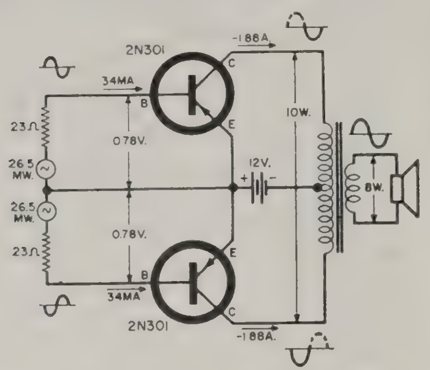


Fig. 4. Basic design of the 8-watt amplifier.

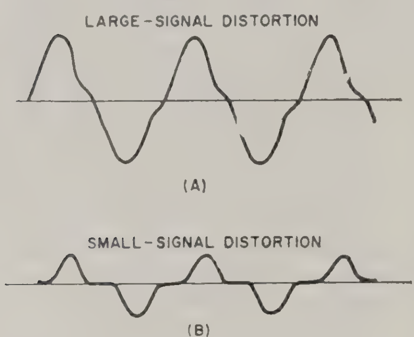


Fig. 5. The distortion due to the crossover.

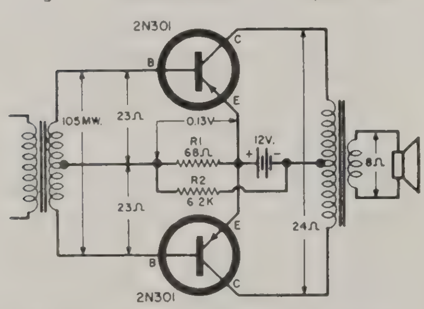
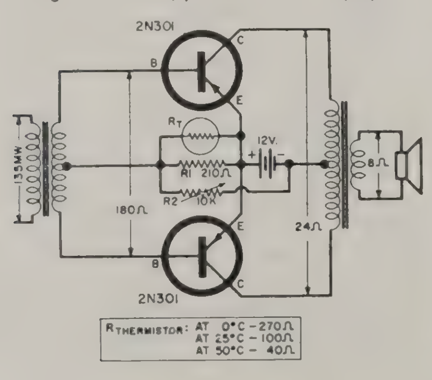


Fig. 6. Pre-bias circuit for the amplifier.

Fig. 7. The final, practical circuit employed.



If a transistor were 100 per cent efficient it would have no power loss in the transistor itself but such a device is, of course, unknown. The 2N301, according to the published data, will dissipate 3 watts for an output of 12 watts in a Class B push-pull circuit. The 3 watts of heat must be conducted away from the transistor or else it will build up to a progressively higher temperature. If the flange temperature increases, the current through the collector increases and the amount of power which is dissipated in the transistor also increases. In other words, if the mounting arrangement of the transistor cannot dissipate 3 watts of power, the resulting temperature build-up will burn out the transistor. It is possible by careful design, to mount each transistor so that it can easily radiate 3 watts into the surrounding air, but on a hot day the efficiency of this heat transfer will suffer because the surrounding air itself is warmer.

In addition to the mechanical mounting methods, there are simple electronic means of preventing thermal runaway and maintaining stability with varying temperature. The most widely used method involves base bias control by means of a temperature-sensitive resistor or "thermistor." A thermistor can either increase or decrease in resistance with temperature, but the latter type is more common. In using a thermistor to control the bias of a transistor the thermistor is mounted close to the transistor heat sink so that any heat rise in the transistor will affect the resistance of the thermistor.

Returning once again to our example of a typical Class B push-pull circuit we can see how a thermistor is used in the circuit of Fig. 7. Here the thermistor, R^t, part of the bias network and in parallel with the 210 ohm carbon resistor, provides the desired 68 ohms at 25°C. When the temperature increases to 50°C the thermistor will be only 40 ohms and this will reduce the forward bias enough to cut the transistor collector current down to a safe value. The principle is simply to reduce bias as temperature goes up and to do this in conformity with the transistor characteristics. If the right thermistor were used, the fixed resistance R_1 would not be required, but most commercially available thermistors are more temperature sensitive than needed and therefore a fixed shunting resistor is often used.

Transformer Considerations

Before we can build the final circuit of Fig. 7 we must give some thought to the transformers. The output transformer should be capable of handling 10 watts and this is usually a standard size. The primary should be centre-tapped with an impedance of 24 ohms collector to collector, and a secondary to suit the speakers to be driven by the amplifier. The wire in the primary should be capable of carrying the peak collector current with not more than half a volt drop.

When we consider the input transformer we see that, as far as the Class B amplifier is concerned, we can select only the secondary and the power ratings. In our example the input transformer must be capable of handling at least 135 mw. and must match the input impedance of 182 ohms. Actually, to minimise distortion, the source impedance should be lower than the input impedance so we should select a transformer which has less than 182 ohms secondary impedance. Because the secondary impedance is lower, some loss in power transfer will occur here which means that the driver stage will have to deliver more than the 134 mw.

(Continued on page 34)

Big New Telephone Exchange for Auckland

At Airedale Street, Auckland, there is at present under construction a building that will be the biggest telecommunications building in the country. This seven storey building will be known as the Airedale Street telephone exchange and will eventually house a telephone exchange of 20,000 lines, together with other telecommunications equipment.

The building, which is expected to be completed in mid-1963, will, initially, have 5,000 lines of exchange equipment installed. This equipment, which is step-by-step of English manufacture, will be added to over the years as the demand increases until the maximum of 20,000 lines is reached. It is not expected to fill the exchange with equipment for at least twenty years.

The building will be very impressive architecturally, being eighty-six feet wide by one hundred and forty feet long, with a large tower at one end. This tower will house all the service requirements of the building, lifts, toilets, etc. There will be a very large expanse of glass in the building and special sun louvres will be fitted on all floors.

On the ground floor there will be barages and an engine alternator room. These engine alternators will provide the stand-by electrical plant that is required in all telephone exchanges in case of power failures. The engine alternators are geared to cut into action immediately there is a failure in the main power supply, thus ensuring that the exchange is "open for business at all times, day and night.

Power and telephone cables will be fed into the building on the first floor and this floor will also house the battery room. The second and third floors will be taken up with two 10,000 line telephone exchanges, one to each floor. Initially, however, the majority of space on these two floors will be taken up by office accommodation for the different Post Office branches, with only half of one floor being taken up with the 5,000 lines of exchange equipment. A test room, which will provide a faults location centre for the entire Auckland city area telephone system will also be located on the third floor.

The fourth floor will accommodate equipment known as carrier equipment and also some office accommodation. Carrier equipment is the equipment that enables more than one conversation to be sent simultaneously over the one line. To do this, the carrier equipment combines the original speech frequencies in a telephone conversation with another frequency known as the modulating frequency. Each conversation is mixed with a different modulating frequency, and a number of conversations can thus be stacked and relayed as a group. At the other end, identical demodulating frequencies reverse the process and return the voice to its normal frequency range.

The fifth and sixth floors will be devoted to tolls use, the technical equipment on the fifth and the operators' positions on the sixth. There is provision in the building for 280 toll operators to operate simultaneously. This, of course, is also a long range plan and there will not be anywhere near that number of operators for at least another twenty years. All the Auckland toll calls will be handled from the building in the future and it will also be the overseas toll centre. From this overseas toll room will be handled all of the New Zealand overseas calls from all over the country. With the COMPAC cable (the submarine telephone cable that will be laid shortly and which runs from Australia to Canada) coming ashore near Auckland, Airedale Street is the ideal situation for an overseas terminal.

Staff cafeterias, social rooms, etc., will take up most of the seventh floor, but there will also be provision made for microwave radio equipment to be installed on this floor. This microwave equipment will be part of the proposed Auckland-Whangarei microwave radio toll link, and will be the same as the microwave equipment used on the Hamilton-Palmerston North link of the North Island toll system. There is provision on the top of the building for a microwave tower to be built, and if this is built, it will stretch a further sixty or seventy feet higher towards the sky.

All the telephone exchanges equipment that will be installed in the building will be English manufactured step-by-step equipment.

When Airedale Street exchange comes into operation it will provide relief for the overcrowded Wellesley Street exchange, and when the toll room is shifted from that exchange, will allow for additional equipment to be installed there, building the exchange up to an ultimate of 15,000 lines for Auckland city subscribers.

When Airedale Street is fully in use, and this is not expected for at least another twenty years, there will be an approximate total of 600 staff in the building, both technicians and toll staff. It will then truly be the biggest telecommunications building in the country.

* * *

NEW BRITISH PAY-TV SYSTEM

An all-British system of pay-TV has recently been demonstrated in London. Viewers can either have a coin box or a credit meter and the programmes can come to them by wire or via an aerial.

The firm responsible is a new company, Choiceview, which has been formed in equal partnership by the Rank Organisation and Rediffusion, and which aims to develop and establish systems of subscription television in Britain and overseas.

Both the parent concerns have immense experience in the design and manufacture of electronic equipment. Rediffusion has a wealth of special knowledge in the design, construction and operation of wire systems for the distribution of radio and TV programmes, and the Rank organisation contributes its experience of film production, distribution and exhibition, and of a wide range of other entertainment activities.

how good are they?

Theodore M. Hannah

(Published by Special Arrangement with Electronics World)

THERE is little doubt that the Russians can build good, reliable electronic equipment—the various Sputniks and space probes have proved that. But does the same high quality carry over to the home electronics field? How do Soviet radios and TV sets compare with those produced in the West? How reliable are they? What kind of service does the set owner get? What are some of the other problems?

Before looking at the sets themselves, it might be useful to look briefly at radio and television broadcasting as it is in the Soviet Union.

The Broadcasting System

For reasons of efficiency and economy, the Russians have found it advantageous to build a vast network of wired-radio broadcasting in preference to the usual network of broadcast stations. In the Soviet system, a relatively small number of strategically located transmitters relay the programmes of Radio Moscow and certain regional centres. (The programmes are also carried by wire line). Received in thousands of wired-radio receiving stations, the broadcasts are amplified and distributed to loudspeakers set up in public squares, parks, street corners, in homes, apartments and public buildings, and in farm villages. The listener can adjust the volume but he cannot change programmes. There are now 30 million such "radio points" (speakers) in the U.S.S.R.—this is about one speaker to every seven persons. There are about 25 million radios in use: 1959 production was 4 million sets.

As with many European countries, the Soviet Union is now placing considerable emphasis on FM broadcasting. By the end of 1960, FM stations were to be in operation in 65 cities. FM is intended to supplement the wired-radio system, particularly in the major cities.

At the beginning of 1960 there were 83 TV stations in operation in the U.S.S.R. These served an area with a potential audience of 75 million. There are now about 4 million TV sets. The current Seven-Year Plan calls for 160 stations and 15 million receivers by 1965. The 1959 production of TV sets was 1.3 million.

The Sets

Generally speaking, Soviet radios and television sets are well-designed and incorporate many of the latest features found in American sets. They are, however, plagued with an inordinate amount of service trouble. This is due primarily to poorly designed and constructed components.

Soviet radios tend to be larger and heavier than the usual American set. They are generally a.c.-powered (a.c.-d.c. sets are not common) or, particularly in rural areas, are battery-operated. Consolo and table-model radiophono combinations (of the kind not generally made in the U.S. since the war) are produced in fairly large numbers. The deluxe radios cover several bands: long-wave (150-415 kc.), medium-wave (520-1600 kc.), and shortwave (5.5-12.2 mc.). The FM broadcast band (64.4-73 mc.) is also often included.

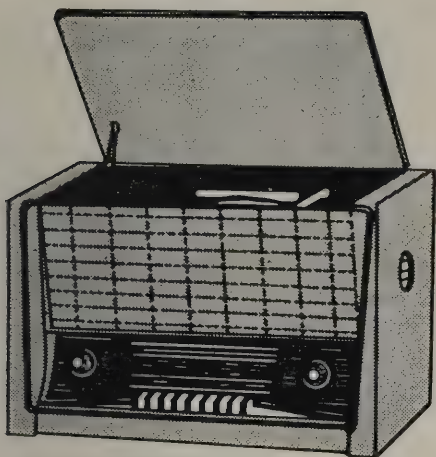
High-fidelity is stressed in the more expensive sets. Separate bass and treble controls, wide-range frequency response, 10-20 watts of audio output, and four to seven speakers are all common in the deluxe model radios.

Transistor portables have proven to be as popular in the U.S.S.R. as in the U.S. and are in short supply.

A word about stereo. The first stereo records and players were produced at the end of 1959. Also, experimental stereo multiplex broadcasts have recently begun.

Soviet TV sets are designed for the 625-line, 25-frame standard which is in use throughout most of Eastern Europe. Channel width is 8mc. Standard i.f.'s are 34.25 mc. for video and 27.75 mc. for audio. There are 12 channels—the first five between 49 and 100 mc. and the other seven between 174 and 230 mc. (Not all 12 channels are in use, however. The Moscow telecentre broadcasts on two channels; other cities have only one channel.) A u.h.f. band (470-850 mc.) is planned for the future.

The newer sets feature 110° picture tubes, printed circuits, and remote control. Semiconduc-



A new Russian AM-FM radio-phonograph. Push-button tuning and printed circuits are used.

tors are widely used (at least one all-transistor set is being developed). The most common screen sizes in the new sets are 14, 17, and 21 inches; many 7- and 10-inch sets are still in use, however.

A typical TV set, called the "Voronezh," covers all 12 TV channels (many earlier sets received only the first five channels), but does not receive the FM broadcast band. The set uses printed circuits and has keyed a.g.c. and automatic fine tuning. Some other specifications: sensitivity, 200 microvolts; horizontal and vertical resolution, 500 lines, tonal gradations on standard test pattern, 8; audio frequency response, 120-6000 cps; and power consumption, 140 watts.

A typical new, deluxe TV receiver has a 23-inch screen, 21 tubes and 19 diodes, seven speakers, remote control, and provisions for FM broadcast reception.

Colour television is not yet in regular use in the U.S.S.R. Experimental colour casts have been made, however, and one plant is making pilot models of a colour receiver. To acquaint service technicians with colour TV, the electronics magazines are carrying articles on the subject.

Service

"If the electronic equipment in our Sputniks can operate so reliably, hasn't the consumer the right to expect the same reliability in his radio, television set, record player, or tape recorder?" This complaint in a Soviet newspaper is typical of many others and points up the fact that Russian radios and TV sets are often not very reliable. The radio equipment in Sputnik III operated for 16,500 hours, yet new television sets often fail within two or three days of purchase. More than half of the radio-phono combinations handled by Moscow's largest department store had to be sent back to the repair shop—even before being sold. Up to 75 per cent. of some TV sets require service during the warranty period.

The reason for this appears to lie in poor quality control during production. Inferior parts plus careless assembly add up to major headaches for the consumer and the service technician.

A new deluxe Soviet TV set with a 23-inch screen, 21 tubes and 19 diodes, 7 speakers, remote control, and FM broadcast reception.

Soviet electronic products (radios, TV sets, recorders, etc.) carry a six-month factory warranty; during this period repairs are made without charge in "warranty repair" service shops. The foreman of one of these shops blamed premature failures in TV sets on factory workers who simply do not care enough about reliability. He found particular fault with poor construction and alignment of TV front ends. Other service headaches include: coils wound with enamelled wire from which the enamel wears off, causing shorts; poorly constructed controls on which the stops break, permitting the shafts to spin all the way around; speaker voice coils which break loose from the cone; fuses which fail to blow under overload, causing burned-up power transformers; poorly constructed phono motors, etc.

An official study found that tube failure was responsible for 31 per cent. of TX failures; picture tubes, 4 per cent. (these are guaranteed for 750 hours); selenium rectifiers, 5 per cent.; other defective components, 9 per cent.; and defects in manufacture and assembly, a whopping 18 per cent.

The electronics industry is frequently exhorted by the government to improve the reliability of its products. As an official of the Ministry of Communications put it:

"The unsatisfactory quality of television sets now being produced has resulted in a corruption of the very concept of the factory warranty. Today the factories guarantee not the reliability of the sets but the purchaser's right to free repairs for a period of six months. The service shops must fix the factories' defective merchandise."

The high cost of supporting the "free factory warranty" is also criticised. It has been calculated that the warranty feature automatically adds 80 rubles (8-20 dollars, depending on the exchange rate) to the cost of every TV set produced. The 11 million sets to be produced by 1965 will thus

(Continued on page

The Russians are poking fun at the poor reliability of their TV sets in this cartoon from a recent issue of the Soviet magazine "Radio." The sets are shown "in orbit" between the set owner and the repair shop.

A Simple Classification of Junction Transistors

By Irving Spackman . . .

EVERY few days we read of new types of transistors being produced, and the species and type is mentioned with bewildering nonchalance. In an endeavour to sort out this multitude of types and processes, the writer has produced a few notes which it is hoped may help others to create some order out of the apparent chaos. It is assumed that simple semi-conductor principles have been previously studied and no major reference will be made herein.

Generally speaking we can classify junction transistors in four major categories: grown, alloy, electrochemical, and diffused, according to the methods used to produce the emitter region of the device.

In this scheme, the diffused category includes only one major type of the many types of transistors produced by diffusion; others made also by diffusion are listed together with alloy, grown and electrochemical processes.

The Various Techniques

The first junction transistors, in 1951, were made by the GROWN JUNCTION process. This type of transistor consists of a rectangular shaped bar cut from a germanium crystal which has been grown from a molten mixture containing a small portion of certain impurities. The emitter and collector connections are made to each end of the bar, whilst the base contact is made to a region usually near the centre of the bar as shown in Fig. 1.

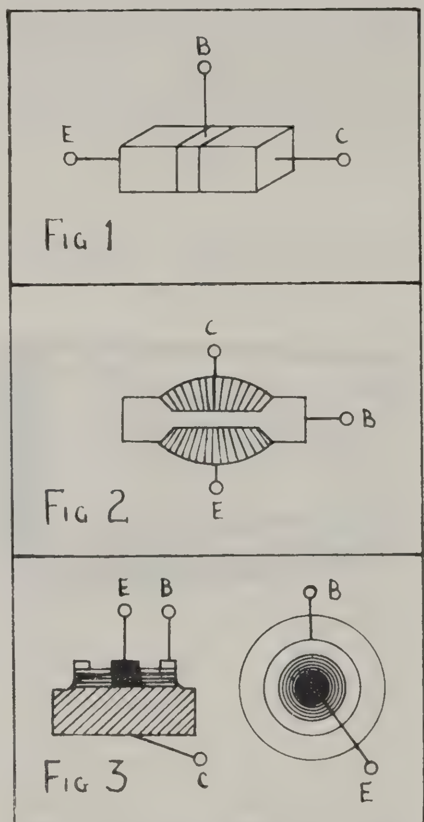


Fig. 1.—Grown Junction Transistor. Fig. 2.—Alloy Junction Transistor. Fig 3.—Mesa Type Diffused Base Transistors in Cross Section.

Soon after the grown junction technique was introduced another method, the ALLOY technique, was evolved. In this system small mounds of indium were fused or amalgamated into opposite sides of a thin slice of suitably prepared germanium, as shown in Fig. 2. To each of these mounds of indium a wire was fixed to produce the collector and emitter contacts, and the base contact was fused on to the central germanium wafer.

The one main problem was that both these systems would not operate at very high frequencies. Then attempts to reduce the physical size of the sections of the transistor in an attempt to raise the working frequency lead to the introduction of electro-chemical etching and plating methods and from these to the development of the SURFACE BARRIER transistor. The construction of the surface barrier transistor is similar to the alloy method except that small depressions are etched into the germanium slice to provide contact for the collector and emitter dots which are much smaller than in a conventional alloy type transistor.

It is interesting to note that using these methods already described, all regions of the transistor, that is, collector, emitter and base are generally of uniform resistivity, whereas diffusion processes can produce non-uniform regions of resistivity with consequent better performance.

Now we come to the process which provided further improvement in performance and was capable of a higher degree of control—the diffusion system. As mentioned previously the use of such a system will enable the production of non-uniform resistivity regions thus providing better electrical characteristics.

The diffusion of the required impurities can take place from within the crystal or through the surface region from outside intentional contamination, usually called gaseous diffusion. It is also possible to combine diffusion techniques with one of the three older type processes mentioned earlier—for example a non-uniform base region can be produced by diffusion and the emitter and collector junctions added by alloy methods. Any other combination can be used if desired. As a result of this flexibility, diffused transistors may assume any one

of several physical appearances. Another method is also common, this being the MESA construction as seen in Fig. 3 in which the semiconductor wafer is etched down in steps so that the base and emitter regions remain as steps above the collector area.

We show here a classification scheme which will illustrate how diffusion is combined with other transistor manufacturing processes to produce different types of composite structures.

Transistor Type Classification

1. Double-Doped
2. Grown Diffused
3. Rate-grown
4. Melt-back
5. Melt-back Diffused
6. Alloy or Fused
7. Diffused Alloy (Drift)
8. Alloy-Diffused
9. Diffused-Base
10. Surface-Barrier (SBT)
11. Micro-Alloy (MAT)
12. Micro-Alloy Diffused (MADT)
13. Diffused - Emitter, Diffused-Base or Double-Diffused.

Grown junctions are used in 1 and 3.

Diffusion techniques are used in 2, 5, 7, 8, 9, 12, and 13.

Alloy junctions are used in 6, 8, and 9.

Electrochemical etching and plating techniques are used in 10 and 11.

A brief description of the classification scheme will help to explain a few of the more complex types.

1. Double Doped Transistors. This is an original type of grown junction formed by growing a crystal and successively adding p and n type impurities to the mixture while the crystal is being grown.

3. Rate Grown; Something Called Graded Junction Transistors. These are really only a variation of the double doped method. (1). The growth rate is varied in a periodic manner so that the crystal contains mostly p type impurities during one part of the growth cycle and mostly n type impurities in another part. This method produces a crystal from which an n-p-n transistor can be cut.

4. Melt Back and also Melt Quench Transistors. These are a variation of Rate Grown transistors (3) above in which the rate growth is carried out in a small way, physically speaking. This produces a thinner base region and hence better high-frequency performance.

2. Grown Diffused Transistors. As mentioned previously this is made by combining the diffusion method and the double doping process. In this case suitable n and p type impurities are added simultaneously to the mix while the crystal is grown. Subsequently, the base region is produced by diffusion during the continued growth of the crystal.

5. Melt Back Diffused. This is really just a combination of the melt-back process with subsequent diffusion process applied to produce the base region.

6. Alloy or Fused Transistors. These have already been described earlier.

7. Diffused Alloy (Drift) Transistors. There is a difference in the use of the word drift in scientific literature and commercial use. In scientific parlance a drift transistor is any type which has a non-uniform or graded base region that provides better high frequency performance than a similar uniform-base construction. However, the drift term when used commercially, generally refers to a diffused alloy type transsistor. Such a transistor is produced by combining diffusion and alloy techniques. The semi-conductor wafer first is subjected to a gaseous diffusion to produce the non-uniform base region then the alloy collector and emitter junctions are added.

8. Alloy Diffused Transistors. This is another type made by using alloy material containing both n and p type impurities. The emitter-base junction is produced by the conventional alloy processes, while the base region and the collector-base junction are formed by diffusion. The collector region is the original semi-conductor material. There are other similar systems to this as well.

9. Diffused Base Transistors. This transistor type is also made by combining diffusion and alloy techniques. In this case a non-uniform resistivity base, and the collector-base junction are formed by gaseous diffusion into a semiconductor wafer that makes the collector region. The emitter-base junction is formed by a conventional alloy junction on the base side of the diffused wafer.

10. Surface Barrier Transistors (SBT). This consists of a wafer of semi-conductor material into which depressions have been etched on opposite sides of the wafer as described previously. The emitter-base and collector-base junctions are then formed by electroplating a suitable metal on the semi-conductor in the etched depressions with the original wafer forming the base.

11. Micro-Alloy Transistors (MAT). This is only a variation of the surface barrier type in which suitable n or p type impurities are first plated in the etched depressions and then alloyed into the p or n type base wafer.

12. Micro-Alloy Diffused Transistors (MADT). This most modern development is made by incorporating diffusion techniques with the micro-alloy type transistors described above. In this case the semiconductor wafer is first treated to gaseous diffusion to produce a non-uniform base region prior to the electrochemical plating process being used.

13. Diffused Emitter and Diffused Base and Double Diffused Transistors. These types consist of a base wafer which is treated with gaseous diffusion of both p and n type impurities to form 2 p-n junctions in the original material.

References:

i. J. S. Saby, "Recent Developments in Transistors" Tele-Tech, Vol. 10, Dec. 1951.
ii. B. Cornelison and W. A. Adcock. Transistors by Grown Diffused Techniques 1957, I.R.E. Wescon Convention, Part 3.
iii. R.C.A. Reviews Vol. 14, Dec. 1953, Vol. 18, March 1957.
iv. Texas Instruments Application Notes No. 7 and References.
v. Mullard Reference Manual of Transistor Circuits.

Overseas Notebook . . .

Super Sensitive Electronic "Sniffer"

Our sense of smell is sensitive enough to detect certain odours in concentrations as little as one part in a million parts of air.

But scientists at the Westinghouse research laboratories have developed an electronic "sniffer" that is even more sensitive and much more accurate. It not only detects but exactly measures concentrations of gases as low as one part in 10 million parts of air. In contrast to the human sense mechanism, odour has nothing to do with its operation.

Called an electronegative gas detector (EGAD), the new instrument was developed primarily to detect and measure the concentration of a gas called sulfur hexafluoride (SF_6). This gas is an inert, odourless, colourless, non-conductor of electricity. It is sealed under pressure inside high-voltage electrical apparatus, where it provides electrical insulation or is used to quench electric arcs. One use of the sniffer is to locate minute leaks through which the SF_6 gas might escape. It also measures the trace amounts of any leakage. The instrument can detect a leak so small that the escaping gas in an entire year would fill only the space inside a pack of cigarettes.

* * *

Semimetal Switches May Increase Computer Speeds

Metals such as antimony and bismuth may increase still further the already amazing speeds at which computers or "electronic brains" operate.

The "nerve cells" of computers are their vacuum tubes or transistors—the devices that serve as switches for controlling the flow of electric current. The faster the switches function, the faster a computer calculates.

A new type of controlling device made of semimetal can theoretically operate in a billionth of a second, which is much swifter than present-day transistors, according to Dr. Benjamin Lax of the Massachusetts Institute of Technology's Lincoln Laboratory. Such switches, still in the experimental stage, may reduce operating costs and open up a new era for advances in electronics.

A slight amount of lead or tellurium must be added to the semimetal to enable it to operate as a switch or controlling mechanism. The lead or tellurium enters into the crystalline structure, creating an electrically unstable situation in which an electric current can be easily induced.

Superconductive Magnets

Scientists of the Radio Corporation of America have developed a new mass-production process that opens the way for the first time to widespread practical use of extremely simple superconductive magnets, using no power, to generate enormous magnetic fields for large nuclear research machines and for ultrasensitive receivers used in radar, radio astronomy, and space communications.

The new process was described by RCA research executives as a technical advance that may rival in importance the development of mass-production techniques for transistors.

The RCA development is a simple chemical method for rapid and continuous growth of crystalline niobium-tin, a compound superconducting material recently found to possess an ability to generate and sustain very strong magnetic fields without any power dissipation. This means that magnets made with the material will continue to operate indefinitely without consuming any power except for a small initial voltage to start a current flowing.

Until now, no satisfactory method has been devised to produce the material in the desired crystal form in quantities necessary for widespread use, largely because of the extreme brittleness of the crystalline substance and the consequent difficulty of working with it. The RCA laboratory apparatus is capable of producing uniform crystal coating of niobium-tin on a fine wire at the rate of 30 feet per hour. Production refinements are expected to greatly increase this rate.

According to the RCA scientists, the finished wire has performed with "outstanding" success in tests involving as many as ninety turns of wire around a three-quarters inch diameter coil form. In addition, tests on short-wire lengths performed at the Lawrence Radiation Laboratory, University of California, Berkeley, indicate that the wire remains superconductive in 94,000 gauss magnetic fields, while supporting a current of 7 amperes. This represents a current density in the superconductive coating of 100,000 amperes per square centimeter. These tests demonstrate the feasibility of winding the wire in any desired lengths to form extremely powerful magnets without the danger of its cracking or otherwise losing its useful properties. The RCA scientists added that the same basic process has been used to produce hollow tubes and thin films of crystalline niobium-tin for possible application in new types of electronic devices for communications, space, and computer functions.

* * *

Shatterproof Light Bulb Made With Silicones

A shatterproof electric light bulb has been developed by an American company. Called "Flamescent," the bulb can be dropped onto a hard surface without breaking.

The light consists of a bulb wound with Fiberglas yarn. The glass and yarn are bonded into a single unit with a rubbery silicone adhesive. The Flamescent casts a warm, flamelike glow, and yet its lumen, or luminous power, output is higher than that of any other processed bulb. It gives a glareless light, and lasts at least three times longer than conventional light bulbs, the manufacturer says.

The bulb is made by the Duro-Test Corporation, North Bergen, New Jersey.

* * *

New Nuclear Research Device

In these days of remarkable scientific and technical progress, many new and extraordinary machines are constantly being developed. One of these, research machine that detects one foreign (or different) atom among more than 1,000 million atoms. This the company says, is like a detective finding his wanted man among all the people of North America, South America, Europe and Africa.

* * *

Television for "Northern Star"

Shaw Savill Line's new passenger liner Northern Star (22,000 tons) will be fitted with a television system providing a completely co-ordinated internal and off-air service all over the world. This is to be supplied and installed by Marconi's Wireless Telegraph Co. Ltd., to an order negotiated by Marconi Marine.

Northern Star's passengers will be able to receive local television programmes at ports of call, and will also have the added facil ty of closed-circuit telecine and live television programmes while the liner is at sea.

Following similar installations for the Orient Line's Oriana and Canberra, this will be the third sea-going TV system to be supplied by Marconis.

Northern Star is being fitted out at Vickers Naval Yard at Newcastle-upon-Tyne.

Overseas Notebook (continued)

New Aid To Meteorologists

The United States National Bureau of Standards has reported the recent development and installation of "Ephi," a new system for locating the source of natural static discharges or "sferics" as they have been colloquially called.

Installed near Brighton, Colorado, by the Navigation Systems Section of the Radio Systems Division it is capable of appreciably greater accuracy than direction finding systems previously used. The system was developed by G. Hefley, R. F. Lindfield, T. L. Davis and R. H. Doherty.

The antenna system consists of three 125ft towers spaced about four miles apart, forming the vertices of an equilateral triangle. The signals received at each antenna are fed over coaxial cables to the central control station of the system. Here electronic equipment determines the relative difference in time of arrival of the sferic signal from each antenna, and, from this, the direction from the control station to the lightning source is automatically determined.

Since sferics travel with the speed of light and the antennas are so closely spaced, the differences in time of arrival at the three antennas are so small that they are measured in microseconds. The maximum difference in arrival time between the antennas at Brighton is only about 21 usec. The Ephi equipment can make such measurements of time difference with an accuracy of a small fraction of a microsecond.

In addition to determining the direction of arrival of sferic signals, the equipment counts the total number of sferics occurring in any desired time interval, and can count the number of sferics arriving from several different directions at the same time. The sferic waveform can also be photographed, either with still or motion-picture cameras, and the record retained for further detailed studies aimed at a better understanding of radio wave propagation as well as the nature of the lightning itself.

In addition to its value as a research tool, "Ephi" is potentially of value in tracking such severe weather phenomena as tornadoes and hurricanes. These storms are usually accompanied by sferics of high intensity which can be detected by the equipment.

The Ephi station at Brighton can pick up sferic signals originating in storms far offshore in the Gulf of Mexico or the Atlantic Ocean. Two such stations, located a few hundred miles apart, could accurately "fix" the position of a storm at distances of many hundreds of miles from either station.

* * *

New Molecular Electronics Department

Westinghouse Electric Corporation has announced the formation of a new department for the development, manufacture and marketing of molecular electronics functional blocks.

D. W. Gunther, general manager of the company's semiconductor department at Youngwood, Pennsylvania, in the United States, said the new group within his organisation will be known as the semiconductor molecular electronics department and will be headed by Fred M. Heddinger, former assistant to the general manager.

"The formation of this activity," Mr. Gunther said, "marks another step by Westinghouse toward exploiting commercially the molecular electronics field in which the company has pioneered in development."

The Westinghouse molecular electronics development effort, he explained, is a new electronics science which employs "blocks" of semiconductor materials to perform circuitry functions previously accomplished by separate components such as transistors, diodes, resistors and capacitors.

* * *

New Electric-Drive System For Vehicles

A United States engineering firm has developed a four-wheel electric-drive system for trucks and other vehicles, which it believes "may some day radically change the design of passenger automobiles." The developer of the system is Jack & Heintz, Inc., of Cleveland, Ohio.

In the new vehicle, a standard engine turns a generator which creates electric power for small electric motors on each wheel. A "frequency changer" regulates the power going to each wheel, enabling the engine and wheels to operate at different speeds.

The new system, Jack & Heintz says, eliminates axles, transmissions drive shaft and differential, and reduces the weight of a conventional truck by about a ton. The company expects to have the new electric-drive vehicle ready for testing before the end of 1961.

New Lightweight Airborne Radar

The Radio Corporation of America has announced the introduction of the lightest airborne weather radar ever built, a unit so compact that it will enable many small planes to use radar equipment for the first time.

Designated the AVQ-55, the new X-band system makes extensive use of transistorised circuits for the maximum possible reductions in size, weight and power requirements, according to Joseph R. Shirley, Manager of RCA's Aviation Equipment Department.

The AVQ-55, which weighs 40 pounds and has a range of 90 miles, will be delayed for the first time at the National Business Aircraft Association meeting in Tulsa, Oklahoma.

While designed for the general aviation market, it is especially suited for small twin-engine planes where space, weight and electric power are at a premium, Mr. Shirley said.

"This new equipment permits the small business aircraft operator to enjoy the weather detection advantages heretofore available only to larger aircraft, and to plot a smooth, time-saving course through and around storm areas," he commented. Mr. Shirley said the new radar represents new concepts in design and packing and consists of three basic units: antenna, receiver-transmitter, and indicator. Antennae are offered in a choice of 12, 15, or 18 inches.

* * *

"Oriana" Television

A report on the TV installation aboard the P. and O.-Orient liner Oriana, has been made by the ship's chief radio officer.

Sent from Suva during Oriana's second voyage, the report says that from the start the installation operated technically according to plan and that although they experienced a few minor troubles of the type inherent in most electrical installations, at no time during the two voyages did the programmes fail to go out on schedule.

In port the local T.V. programmes are received and put on the circuit. The system permits simultaneous reception and distribution of both B.B.C. and I.T.V. programmes in the United Kingdom area, of up to three in Australia, and up to nine in the United States. The various programmes are there for selection by the viewer, using the selector switch on the T.V. set in his cabin.

The audience viewing programmes in Oriana's public rooms numbers up to 100 to 150 in the first-class, and up to 300 or more in the tourist class.

TWO METRE CONVERTER USING NUVISTOR TRIODE

(Continued from Page 12)

6CW4 is very high between 25 and 30 db. The tubes ability to handle strong signals is very good, superior to the 6J4 grounded grid amplifier. This is attributed to the use of the anode dropping resistor, as this seems to extend the grid base of the tube to a certain extent. We are looking now at the 47K grid resistors and wondering if a selected low noise type resistor might make an improvement over the good quality $\frac{1}{2}$ w carbon type used.

The converter is very good on weak signals. Reception over the 240 mile path from Palmerston North indicates that the tube performs will giving adequate gain with low noise.

In all we can recommend this tube to all interested in V.H.F. receivers. It is probably the cheapest and best R.F. amplifier tube currently available in this country and is very easy to handle and adjust.

COIL DATA

All slugs OBA Neosid preferably purple or Black type. All formers OBA slug $\frac{1}{4}$ o.d. x $\frac{3}{4}$ long polystyrene type.

L1 $4\frac{3}{4}$ Turns 20 G tinned copper spaced $\frac{3}{8}''$ The antenna tap 1 to $1\frac{1}{2}$ turns from earth end.

L2 $3\frac{1}{2}$ turns 20 G enamelled spaced $\frac{1}{2}''$.

L3 4 turns 20 G enamelled spaced $\frac{1}{2}''$.

L4 $3\frac{1}{2}$ turns 20 G enamelled close wound.

L5 15 turns 26 G close wound.
LN 16 turns 26 G enamelled close wound.

H.T. Supply voltage 125 6CW4 dropping resistor 6.8k $\frac{1}{2}$w.

PARTS LIST

C1, C2, Cn., .001 mfd Tubular Ceramic.
C3, C6, C9, 50 pf Silver Mica.
C4
C5, C7, C14, .002 mfd Ceramic Disc.
C8, C10, C11, C12, .01 mfd Tubular Ceramic.
C13, 10 pf Silver Mica.
R1 47k $\frac{1}{2}$w.
R3, 470k $\frac{1}{2}$w.
R4, 100 ohms $\frac{1}{2}$w.
R5
R6, R9, R15, 1k $\frac{1}{2}$w.
R7, 4.7 meg $\frac{1}{2}$w.
R8, 68k $\frac{1}{2}$w.
R10, R13, 100k $\frac{1}{2}$w.
R11, 220k $\frac{1}{2}$w.
R12, R14, 470 ohms $\frac{1}{2}$w.
R.F.C. 2.5 mh R.F.C.
J1. Belling-Lee Coax Socket or equivalent.
J2, Coaxial connector to suit accompanying receiver.
X, crystal. This one is on 46.5 mc/s overtone.

record review

by Professor C. G. F. Simkin

KEY:

- • Not recommended because of poor performance or recording.
- * Recommended although the performance or recording has faults.
- ** Strongly recommended because both performance and recording are excellent.

***BEETHOVEN, Violin Concerto in D Major, Opus 61. Played by Igor Oistrakh, with the Pro Arte Orchestra conducted by Wilhelm Schuchter. World Record TZ140.**

There is no finer violin concerto than Beethoven's, and none which makes greater demands upon the soloist. Only a highly accomplished performer can realise its possibilities for the violin, and he also needs discernment and taste to capture the rather elusive beauty of the music.

The obvious comparison here is with the recording made some years ago by David Oistrakh and the Swedish Festival Orchestra. One can hardly doubt that the father's performance is superior, both in sureness of technique and warmth of interpretation. Nevertheless, Igor Oistrakh plays impressively, with a clear lyrical tone and sensitive understanding. The first movement, after a hesitant entry, goes splendidly until the cadenza (Kreizler's not Joachim's), marred only by an occasional lapse of intonation. Both soloist and orchestra give a beautiful rendering of the serene second movement, the best part of the whole performance. The soloist is less happy in the final rondo, not quite at ease with its wonderful rhythms, although he finishes well enough (with again a Kreizler cadenza).

The orchestra gives excellent support throughout under a conductor who takes every passage confidently and well. There is, however, an unfortunate lack of balance with the soloist, whose violin has been placed too near the microphone.

• WALTON, Belshazzar's Feast; HANDEL, Zadok the Priest, and From the Censer Curling. Sung by James Milligan (bass-baritone) and the Huddersfield Choral Society, with the Royal Liverpool Philharmonic Orchestra conducted by Sir Malcolm Sargent. World Record EZ1021.

Walton's brilliantly colourful oratorio demands large-scale musical forces. In this recording, the engineers have not overcome the difficulty of making such a performance sound other than blurred and confused. Even if they had, the choir would have marred the result. No words can be caught when it is going full blast, and few in the quieter passages. Their rendering of the unaccompanied, eight-part "By the Waters of Babylon," a fine piece of choral writing, is particularly disappointing. They have, moreover, a graver fault than poor enunciation. Whether they are supposed to express the lament of the Jews in captivity, the barbaric glory of Babylon, or exultation when Belshazzar is slain, the mood is much the same—fuzzily monochromatic.

James Milligan is much better. He has a strong, clear voice and gives a satisfying interpretation of all his parts. The orchestra is excellent throughout, although the recording makes it sound blurred in the louder passages.

The choir is obviously happier in Handel's gloriously secular anthems, but again sings more energetically than clearly. The orchestra keeps up its splendid playing and is now better recorded, although it is given undue prominence by the engineers.

*** Richard Strauss: Death and Transfiguration, Dance of the Seven Veils; Dance Suite. Played by the Philharmonic Orchestra, conducted by Artur Rodzinski. World Record TZ141.**

This record is good value for Strauss enthusiasts, as it gives an early symphonic venture into "music as expression," an excerpt from his most successful opera, and a mature adaptation of Couperin's harpsichord pieces (omitting, however, the courante). It will also be appreciated by admirers of the late Artur Rodzinski, a fine conductor who was a sympathetic interpreter of Strauss.

The dramatic tone poem about a man's struggle with death receives a vividly understanding performance. The Philharmonia plays it brilliantly throughout, especially in the solo passages, and

(Continued on page 34)

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

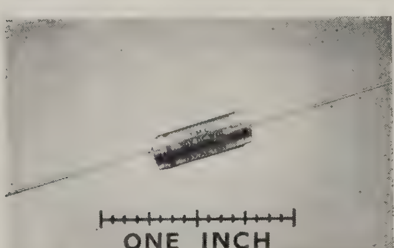
This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars, contact Advertising Manager, "R. & E.," Box 1365, Auckland.

New Range Of Polystyrene Capacitors From TMC

An entirely new range of competitively-priced miniature polystyrene capacitors designed for transistorised and low voltage circuit applications is now available from TMC.

Despite their extremely small size, all capacitors in the new range are for normal working voltages of up to 50v d.c.

Capacitance values are from 0.0005 microfarad to 0.5 microfarad with a closest standard tolerance of plus or minus 1%. Sizes of individual capacitors range from 9/16" (length) by 3/16" (diameter) to 1.15/32" x 25/32", thus offering circuit designers a wide variety of space-saving units.



Although these capacitors are of such small size they retain the superior characteristics of larger polystyrene capacitors:

Insulation resistance 750,000 megohms or 250,000 ohmsfarad whichever is the smaller.

Power Factor not greater than 0.001 at 1 kc/s.

Further details from: Telephone Manufacturing Company Limited, Capacitor Division, Sevenoaks Way, St. Mary Gray, Orpington, Kent.

* * *

New Solid-State Parametric Amplifier and Mixer

Some details are now to hand of the experimental solid-state diode parametric amplifier and mixer which Marconi's displayed at the recent Farnborough Air Show as part of their comprehensive exhibit of aviation electronics. This device, which has never before been on view at the Show, is the outcome of one of a series of investigations which are currently being carried out at the Marconi Research Laboratories in which various possible alternatives in microwave low-noise amplifiers are being systematically explored.

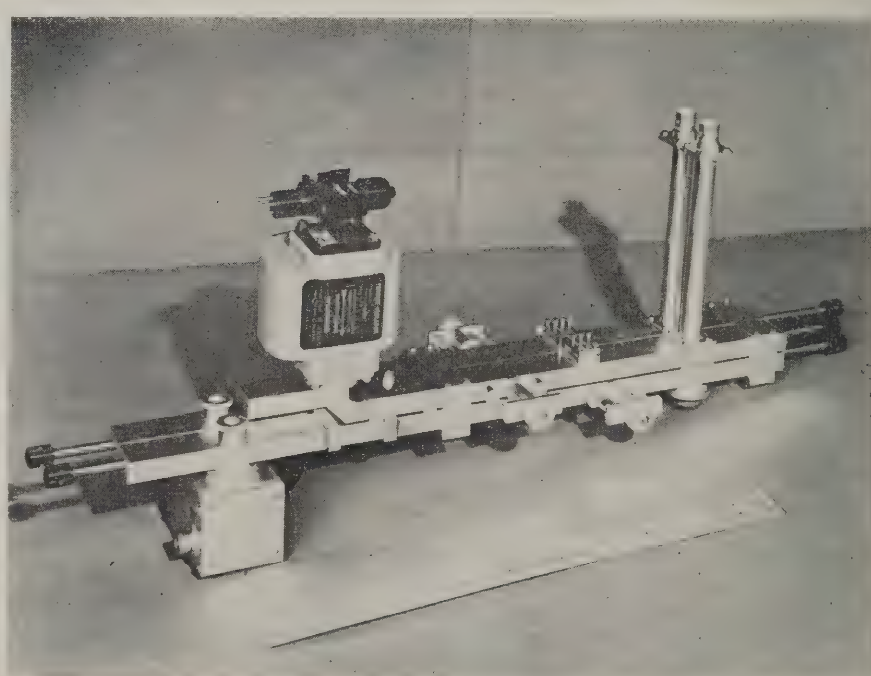
The importance of this combined amplifier and mixer lies in its excellent low-noise characteristics and also because one such unit can replace at least three valved stages in a conventional receiver. Experiments with such a device incorporated in a Marconi type SR100 radar transmitter/receiver (aerial temperature 120°K) have shown it to enhance the overall noise factor from approximately 7 dB to 2.5 dB—equivalent to an increase in transmitter power from 500 kilowatts to 1.75 megawatts.

Of parametric amplifiers in general it can be said that the amplification is derived by the transference of energy from a locally generated frequency (known as the "pump source) into the signal itself.

In this connection a homely, if rough, analogy of how this is brought about is provided by the 'whiter-than-white' washing powders of television advertising fame. Into these, chemicals are introduced which are sensitive to ultra-violet light. When materials washed in these powders are exposed to sunlight some of the invisible ultra-violet content of the sunlight acts upon the chemical, causing it to effect a frequency-conversion of the ultra-violet to the lower frequencoes of visible light. In this way more visible light is radiated from the material than actually impinges on it in the first instance—i.e. amplification takes place, with the visible light representing the signal and the ultra-violet the "pump" source of additional energy.

Physically, the solid-state parametric device bears no resemblance to a conventional amplifier; its external appearance is that of four sections of waveguide bolted together. The amplification process is achieved by two silicon diffused P.N. junction diodes (variable capacitance diodes) mounted within the structure, with an X-band kylstron acting as a 'pump' source.

This particuar parametric ampifier has been designed for experimental use with the Marconi S264 series of surveiance radars and for this reason accepts a signa input of 600 Mc/s frequency. An X-band diode mixer is incorporated to provide, in this instance, an i.f. output at 44.25 Mc/s, but it is emphasised that the device can readily be used at other frequencies over a wide range.



Although its performance has not yet been fully evaluated preliminary testing has shown that the new amplifier holds considerable promise. Signal-to-noise ratios are considerably better than those obtained with a triode, and therefode longer ranges are obtainable, as will be seen from a special PPI display on the stand, on which actual aircraft responses obtained via a parametric amplifier are compared an a side-by-side basis with the same echoes derived from a low-noise triode. The new amplifier has the further important advantage that its working life is not bounded by the deterioration in cathodic emission which is the limiting factor in any thermionic device. It is no more prone to 'spike' damage in radar work than is a triode—and probably less so.

* * *

Esterline Angus Inkless Event Recorder

An inkless event recorder which can operate more than 50 days without a change in charts has just been introduced bq Esterline Angus Instrument Company, Inc., Indianapolis.

Called the 620 Event Recorder with Tempen, this graphic recording instrument is immediately available in both a 10-channel model which sells for less than £300 and in a 20-channel model which sells for less than £350.

The 620 with Tempen detains the proven reliability and versatility of the still available Esterline Angus Model AW (pen and ink) Event Recorder which is used in almost every industry for time, motion, efficiency and quality control studies; and in a wide variety of chemical, physical, medical and psychological research.

Instead of ink—which can spill, run and freeze—the 620 with Tempen uses electrically - heated stainless steel styluses to write 10 or 20 channels of "yes-no" or "on-off" information on special paper. Power to heat the styluses can be obtained from a 120-volt, 50 to 60 cycle source or from a 12-volt storage battery.

Torture testing of the styluses reveals they will last through more than 20 years of continuous operation and retain a response speed of 1/20 of a second. The special chart paper has a non-wax finish which eliminates the danger of marred records caused by external heat, rough handling or discolouration from sun and other strong light.

An easily accessible rheostat can be set to control the width of lines made by the styluses according to individual preference.

Among hundreds of uses for the 620 with Tempen are supervision of heating systems, refrigeration installations, air conditioning systems and a vast range of chemical processes.

In time studies, the inkless event recorder can reveal the productive and non-productive time of any or all machines in a plant. Still other uses include surveys of elevator traffic, highway traffic control systems, circuit breaker action, plastic molding, rubber vulcanising, the opening and closing of doors, vegetable oil processing, phychological testing, qualitative television programme analysis and conveyor operation.

To accomplish these and other jobs, the 620 with Tempen can be ordered with a variety of chart drives—synchronous motor, selsyn and phantom. Available chart speeds range from ¾ inches per hour to 6 inches per second.

All charts are 80 feet long and have rectilinear co-ordinates so arranged that the occurrence of events can be easily timed.

Present owners of Esterline Angus Model AW (pen and ink)) Event Recorders can have them converted to the Tempen writing system at a reasonable cost.

New Zealand Agents: E. C. Gough Ltd., Christchurch.

Philips Microwave Components For 4 and 2 Millimetre Bands

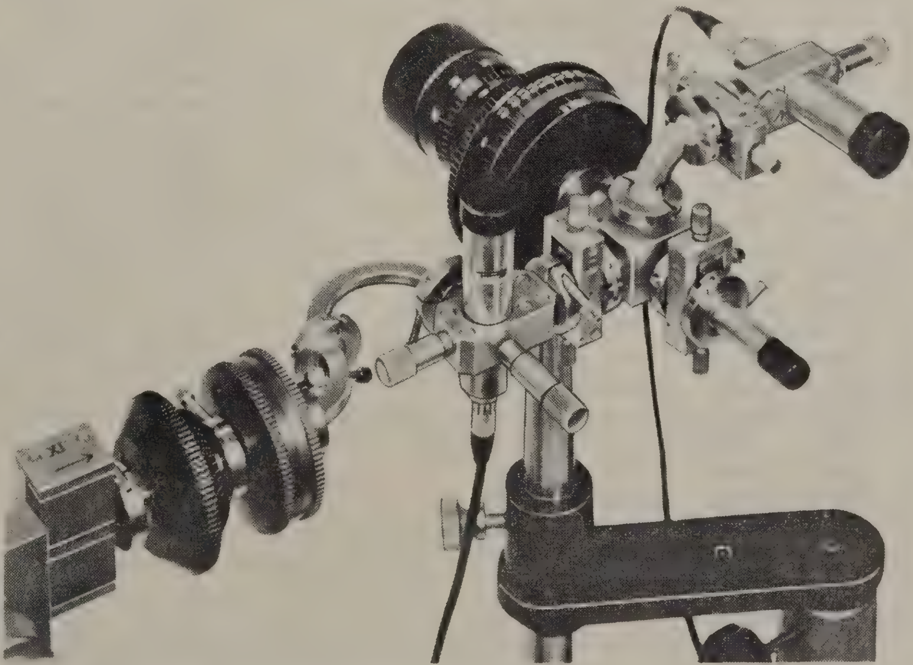
A series of high precision components for the generation, detection and measurement of microwaves in the 4 and 2 millimetre bands is now available from E.D.A.C. Ltd.

This new equipment offers many advantages for research in many fields of fundamental and applied physics.

Nearly all of the instruments are of a completely original design, as practice showed that the usual technique of scaling down components of equivalents of 3 centimetre or 8 millimetre bands did not lead to acceptable solutions. The series of high quality instruments, which features among other things a novel claw-flange construction for the best possible coupling of components, is being continuously extended.

Full details of these and other instruments in the Philips range are available from E.D.A.C. Ltd., P.O. Box 6415, Wellington, and P.O. Box 9338, Auckland.

High Precision Components for the generation, detection and measurement of microwaves in the 4 and 2 millimetre bands.



Shortwave Survey

by MIKE BUTLER

A Listeners' Guide to Broadcasts in English

Greenwich Mean Time is used —frequencies in kilocycles.

* * *

With the international airways strewn with atomic debris, satellites, rockets and needles, many of our readers will wish to get the story direct. Therefore we offer the following schedules with the cautionary note that these two countries change their frequencies and programming often. An asterisk denotes poor reception either on account of weak signal strength or interference.

ARMED FORCES RADIO AND TELEVISION SERVICE (AFRTS)

1900 – 2130	21650*
1930 – 2200	15190*
2115 – 2200	15270*
2215 – 2230	21460
2300 – 0300	21460
2330 – 0000	17815*
0200 – 0600	17770
0200 – 0245	17815
0330 – 0415	21460*
0600 – 1100	6040
0700 – 0915	5965
0730 – 1100	9560

By the time these notes reach you the major broadcasting organisations will have adopted their summer schedules which are due to take the air at the beginning of November. These planned changes will not be the only ones observed however. A marked difference in reception conditions is already noted as signals below nine megacycles are fading much earlier in the mornings, at present about 2000. In the evenings the higher frequency bands above 15 megacycles have improved to the point where the 13 metre band is commonly open until 1000 Generally speaking the best loggings during the past month have been made after 0600 with the daytime signals well below their previous strength.

VOICE OF AMERICA

1815 – 2145	9615
1815 – 1900	6140
1815 – 1830	17760 21485
1830 – 1900	21610*
1830 – 1845	21740*
1845 – 2045	7205
1845 – 1930	17705*
1845 – 1900	15205
1900 – 1930	21520
1900 – 1915	17795 21540*
1915 – 1930	21610
2000 – 2115	21610
2000 – 2100	17710
2000 – 2045	11905*
2015 – 2030	15240 17795 21520 21570
2030 – 2115	15210
2030 – 2100	7265
2045 – 2115	7125
2100 – 2130	17775 21740
2200 – 2230	17710 21520
2215 – 2230	11775 21610*
2300 – 2330	15185 17735 17775
2315 – 2330	21740
0000 – 0115	21740
0000 – 0045	17775
0000 – 0030	17735 17745
0015 – 0030	15155* 15350*
0100 – 0145	17775
0100 – 0115	15135*
0115 – 0230	17855
0115 – 0130	15160* 17745
0130 – 0200	11890
0200 – 0400	15210
0230 – 0330	11890
0345 – 0400	7265
0400 – 0415	5960* 11875
0500 – 0600	7205 9770
0500 – 0530	7265 11805
0730 – 0745	5960* 6025
0545 – 0730	6025 9615*
0600 – 0730	11780
0600 – 0700	5960 9770
0600 – 0615	9545*
0630 – 0730	11805 15205
0630 – 0730	7205 11875*
0630 – 0700	7260*
0645 – 0730	9545*
0700 – 0715	9770
0530 – 0600	5955 6040*
0800 – 0815	Fridays only UNO Programme 9740 11875
0830 – 0945	9600
0830 – 0930	9740
0830 – 0900	9545
0840 – 0930	5985 6185
0900 – 0930	7155* 9650 11960* 15125*
1000 – 1100	15325
1000 – 1045	15185
1000 – 1030	11960*
1000 – 1015	7155
1015 – 1030	9600* 9650 15210*
1030 – 1100	9665*
1045 – 1100	9535 9545*

U.S.S.R.—RADIO MOSCOW

1830 – 1930	9640	0530 – 0600	11730*
1830 – 1900	9705 11710	0545 – 0630	15180
2230 – 2300	15340*	0545 – 0600	9605 9685*
2315 – 2330	11750	0645 – 0715	17900
2330 – 0000	11730 15290	0700 – 0715	15405
0030 – 0130	15290	0700 – 0800	21505*
0230 – 0245	9705	0730 – 0800	17710*
0315 – 0330	9685	0730 – 0745	21640
0330 – 0345	9705	0745 – 0800	15200*
0330 – 0400	7340*	1030 – 1100	6020*
0400 – 0500	9620*	1030 – 1045	9705 11845
0430 – 0500	9605 9685		

NOTE: For many months during the winter and until recently, Moscow used a very successful group of frequencies including 11690, 11855, 11870, 11890, 12005, 15150, 17780, 17880 which provided strong reception from 2300 to 0600. Your correspondent no longer receives these and no direct replacements have been observed.

SURVEY BY COUNTRY

JAPAN: Radio Japan has announced new frequencies to take effect from November 5th. They are 11725, 15195 and 17755 and will carry their General Service. No mention was made of any change to the language schedule and we assume that the times given last month will still apply. The English broadcasts are generally heard after the hour between 0100 and 1000.

LIBERIA: As Africa is one of the rarest regions to receive by radio in N.Z. it was a pleasure to hear ELWA, the missionary station at Monrovia providing us with a really fine transmission on 15155 at 2115. No trouble in tuning this one if the conditions are right.

PHILIPPINES: From Manila, Station DZDA operated by the National Civil Defence Administration on 5970 has been received at fair strength about 1000. This strength suggests that the previously projected 10 kw station is already in operation. Far from being purely a utility station for Civil Defence it transmits informative and entertaining programmes.

RUMANIA: Bucharest has provided us with strong signals on 15245 from 0315 until they sign off at 0330. From 0430 for half an hour another session is noted on 9570 and through interference on 11810. Additional frequencies are 9590 and 11940, but these are only intermittently heard.

SPAIN: Radio Nacional de Espana is well received here with programmes luring the traveller towards this country with colourful descriptions of their land, life and history. Liberal doses of their florid music are included, making these broadcasts very entertaining. They are heard from 2015-2045 through severe interference on the off-band 9366. Also 0315-0400 using the same frequency. During the sessions 0415-0500 and 0515-0600 good signals may be received on 6130 and 9366 especially during the later period.

SWITZERLAND: Regularly received in this country, the Swiss programmes, for me at any rate, are characterised by their accordion bands. Their light repetitive tunes often help to pick the station out from the jumble which exists on the crowded frequencies. Reference was made last month to the highly regarded Swiss DX session. Fine choral music is often heard and this sometimes includes examples of Swiss yodel. Times and frequencies are: 1845-1930 on 7210 and 9545; 0130-3033 on 9535 and 11865; 0300-0415 on 9535; 0415-0500 on 6165 and 11865; 0715-0830 and 0900-0945 on 11865, 15315 and 21605.

THAILAND: The Thai National Broadcasting Station at Bangkok is usually heard at fair strength at 1030 on 11905.

U.S.A.: One of the few commercial shortwave stations in the U.S.A., WRUL "The Voice of Freedom" operated by the World Wide Broadcasting System in New York is at present audible on 17750 from 2000 to 2130.

VIETNAM (PEOPLES DEMOCRATIC REPUBLIC): A strong signal was received from the "Voice of Vietnam" on 9840 between 1000 and 1030.

YUGOSLAVIA: A transmission which has been heard well for many months and which continues to be heard clearly is on 6100 from 1830 to 1900. Other broadcasts in English have been reported but these are either at inconvenient times or on frequencies usually unsuitable for reception in this country.

We have now covered the main sources of shortwave broadcasts in English at present received here between 1800 and 1100. The gentlemen with HRO-60's and a few acres of aerial farmland will no doubt query this statement and murmur many names between Afghanistan and Zanzibar. They are right of course!

Nevertheless an average receiver and a simple outdoor aerial is all that is required to receive most of the stations reported, and we will keep you up-to-date and aware of any newcomers that may be received with this equipment.

SOVIET RADIO AND TV

(Continued from Page 23)

cost an additional 88 to 220 million dollars!

Greater standardisation is also proposed as a means of reducing repairs on TV sets. To date, about 50 models have been produced. It is suggested that if fewer models were made, the technician could learn to service them better.

To keep Russia's 4 million TV sets in working condition there are about 200 service centres (all of course, government-operated) and 7,000 technicians. To serve Moscow's 5 million residents there are perhaps 25 TV service shops. There are about the same number for repairing radios, record players, and recorders. The shops are so specialised that a TV repair shop seldom repairs radios and a radio repair shop usually will not work on a TV set.

In addition to poor-quality sets and parts, the service technician is faced with another problem—that of obtaining parts. The supply of certain types of tubes, resistors, capacitors, switches, and transformers does not meet the demand. In addition, parts distribution, a responsibility of the Ministry of Trade, is often less than perfect. The result is that the set owner, particularly in the smaller towns, must often wait weeks for his radio or TV set to be repaired in the government-operated shop.

Given these conditions, it is not surprising that the set owner sometimes looks elsewhere for service. This has led to instances of technicians doing repair work on their own time. While such "free enterprise" has been condemned in the press, it has at the same time led to promises of better service in the government service shops.

LOOKING AT TRANSISTOR CLASS B POWER OUTPUT

(Continued from Page 20)

previously calculated. In a conservative design the driver stage will be capable of delivering at least twice the driving power calculated for the Class B output stages. The transformer even in this case would not be very large—half to 1 watt handling capacity would be adequate.

Conclusion

Class B transistor amplifiers have the great advantage of requiring almost no quiescent power and are, therefore, very efficient. The design principles are the same as for vacuum-tube push-pull Class B circuits, except that the transistors' temperature characteristics must be taken into account. The detailed design procedure presented here requires only a knowledge of Ohm's Law, arithmetic, and an understanding of characteristic curves.

(This article is based on an original article by W. H. Buchsbaum, Industrial Consultant to Electronics World and revised by our Consulting Editor.)

RECORD REVIEW

(Continued from Page 29)

brings off the climax most convincingly. Salome's dance is less satisfying. Rodzinski strives a bit too hard for effect, and his tempi are not altogether convincing. There is happily a complete recovery in the sharply contrasting dance suite, a work reflecting all the courtly verve and charm of its model. It is well played, with suitable taste and polish.

On the whole, the sound is clean and satisfactory. But it does degenerate in the gavotte, and is never very warm in tone.

Opportunities for Electronics Industry Expansion

Australia had made remarkable progress in the electronics field but there were excellent opportunities for still greater expansion, the Managing Director of Amalgamated Wireless (Australasia) Ltd., Sir Lionel Hooke, said recently.

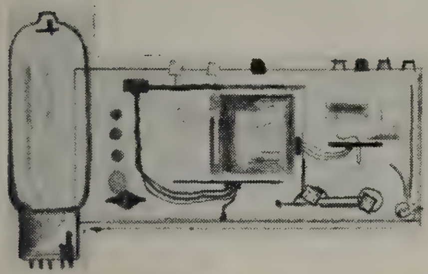
The standard of our engineering profession was very high and, whilst the electronics industry had kept abreast of overseas trends, the home market must be protected as a basis for the building up of a worthwhile export trade.

It was vital that there should not be any legislation of a restrictive nature in Australia which would prevent co-operation and rationalisation if those engaged in electronics felt so disposed.

Sir Lionel said achievement of such co-operation and rationalisation within the industry was important in view of its competitive nature, the diversification of its products, and the need to reach higher production levels to meet overseas competitors' costs. He also said there must be greater encouragement for industrial development.

During his recent overseas visit, Sir Lionel studied latest trends in the electronics industry in Great Britain, Europe, U.S.A. and a number of Asian countries.

Bob's



service shop

This month I again have a couple of believe-it-or-not stories. The first is my own, the second was told to me by a fellow serviceman.

The first concerns TV and goes like this. I was called out to a TV set which had lost all trace of picture. It was quite an easy matter to find the trouble—a faulty PY81 booster diode. Having replaced this I proceeded to carry out the normal routine service checks, linearity, etc. In this case the frame linearity was badly adjusted, the circle on Channel 2's test card being very egg shaped. I made the necessary adjustments until it again appeared as a proper circle. (I might mention that while this was going on the lady of the house was elsewhere). Having finished the alignment I departed to do the next job.

To cut a long story short, the next morning I received a phone call from the lady of the house mentioned above. She was a very injured person and said so in no uncertain manner. Having calmed her down a bit (you didn't think I was a patient man?) I found out what she was mad about.

It appeared that the evening before she had switched her TV set on as usual before the normal programme had started, in order to adjust the fine tuning. She said the salesman had shown her how to make the adjustment with the test card, and lo and behold the nice egg shape which she had been used to was gone. In its place was a wicked circle which this no good serviceman had left after doing the job the day before. She demanded that I go forthwith to readjust it again. Well, I explained to her that the circle was meant to be a circle and not an egg shape. When she said she didn't believe me I suggested that she might phone another servicemen to check up on my explanation. She said that she would and hung up. About ten minutes later she phoned back to say she was sorry, mumbling the while dark and unprintable things about TV salesmen.

The next priceless story from my friend. His partner who is an electrician was called to replace a lampholder in the kitchen of a customer's home. On arriving there he saw the lady of the house ironing the washing with a very old flat iron. While attending to the repair job on the lampholder he noticed that there was on the shelf nearby a brand new automatic iron. Being somewhat surprised at the fact that she was not using it he remarked upon this to the lady. Her reply was that the iron had a green cord. She was superstitious about green and would not use the iron because of this. Also, the day her husband bought it for her three of their relations had gone to their just reward, and nothing would make her use such a thing with a green cord attached. The sparkie promptly swapped the cord for a brown one and left the lady happily ironing with the new iron.

—R. J. HALL.

AUTOMATIC MACHINE DRILLS PRINTED CIRCUIT BOARDS

A new fully automatic printed circuit drill specifically designed for fast drilling of component fixing holes in printed circuit boards, has been produced at the Scottish plant of Ferranti Ltd.

The machine is already being used successfully for drilling the hundreds of printed circuit boards required for the company's Atlas high-speed computer, and Argus process control computer.

Basically, the machine consists of two drilling heads allowing either tandem or single spindle working; a hydraulically - operated co - ordinate table carrying the printed circuit boards which is automatically moved to bring the board hole centres in turn below the drills; and a control system for the drilling action and table movement which enables the machine to work unattended except for loading and unloading.

Drilling is carried out to a grid system, the holes being drilled in a systematic pattern of rows and columns. The basic spacing between rows of the grid system is determined by the pitch of the thread of the precision rack associated with row alignment. A typical pitch is 20 threads per inch giving a spacing between rows of 0.050 in. or multiples thereof. A similar precision rack is used for column alignment.

"It's a people clip."

Basic Principles of Volume Expansion

R. J. HALL

Volume Range

The volume range of any sound reproducer is the difference between the loudest sound output and the lowest level which may be masked out by background noise, hum, needle scratch, etc.

The volume range of the average AM transmitter is about 50 db maximum, and of records about 30-40 db, sometimes particularly with the stereo type, somewhat less.

Some orchestral programmes have a volume range of 50 db to 70 db, therefore it will be seen that some form of compression will be necessary both in the AM transmitter and/or the record. In New Zealand the N.Z.B.S. have peak limiters in the line from the studio to the transmitter which compress the programme by a fixed amount of 5 db. This is in addition to the manual compression which is controlled by the panel operator. However, a lot of programmes have a volume range of less than 35 db and are theremore not compressed in any way

It will be seen from the above remarks that some form of expansion will greatly improve the realism of orchestral records as reproduced by either the home record amplifier or high quality radio receiver, although the latter case is somewhat doubtful because of the limitations imposed by the fairly narrow bandwidth as transmitted by AM stations. In the case of FM of course it would be a different story.

One advantage of the use of volume expansion is that it reduces the background noise of records. However, a serious disadvantage of automatic volume expansion is that the circuit can never duplicate the original volume range, because it can have no way of knowing what the original levels were. It will make the loud parts louder and the soft parts softer but always by the same amount dependent on the setting of the expansion control. Also, of course, where you have both a loud and soft passage rendered simultaneously the compressor will compress both by the same amount and thus may push the soft passage below the noise level.

Practical Aspects

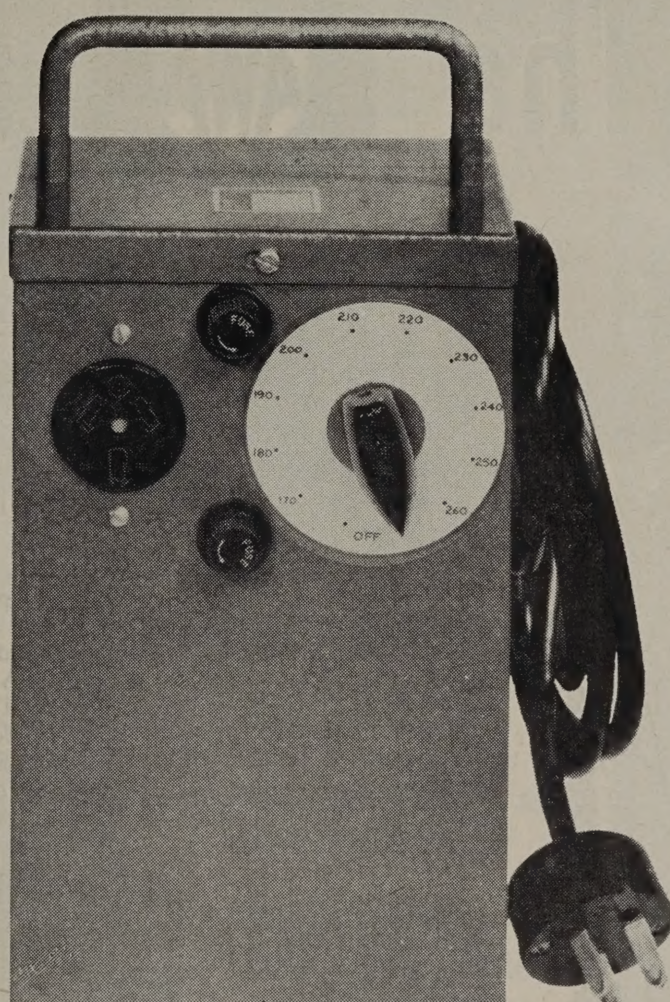
Most experts agree that any expander used should have as rapid an attack time as is possible in practice, but that the fall should be very gradual, up to 1 or 2 seconds, sometimes more. The usual amount of volume expansion used should be controllable by the listener to between 10 and 20 db.

It is hoped to present at some future date a practical circuit for the interested reader to build. If you are so interested how about dropping a line to the Editor telling him so.

A new safeguard for T.V. servicemen..

Work safe . . . Isolate your TV set from the mains while you work on it. The Beacon Isolator is designed to handle all TV set loads in complete safety.

A wide range of taps is provided so that you can test the set over a range of input voltages even when the mains are above or below 230v. This is helpful for soak tests or low supply voltage runs to show up intermittent faults.



THE BEACON T.V. ISOLATOR

SPECIFICATIONS :

Input: 230V.

Output: Switch selected from 3-pin socket of 0-110-170-180-190-200-210-220-230-240-250-260 volts.

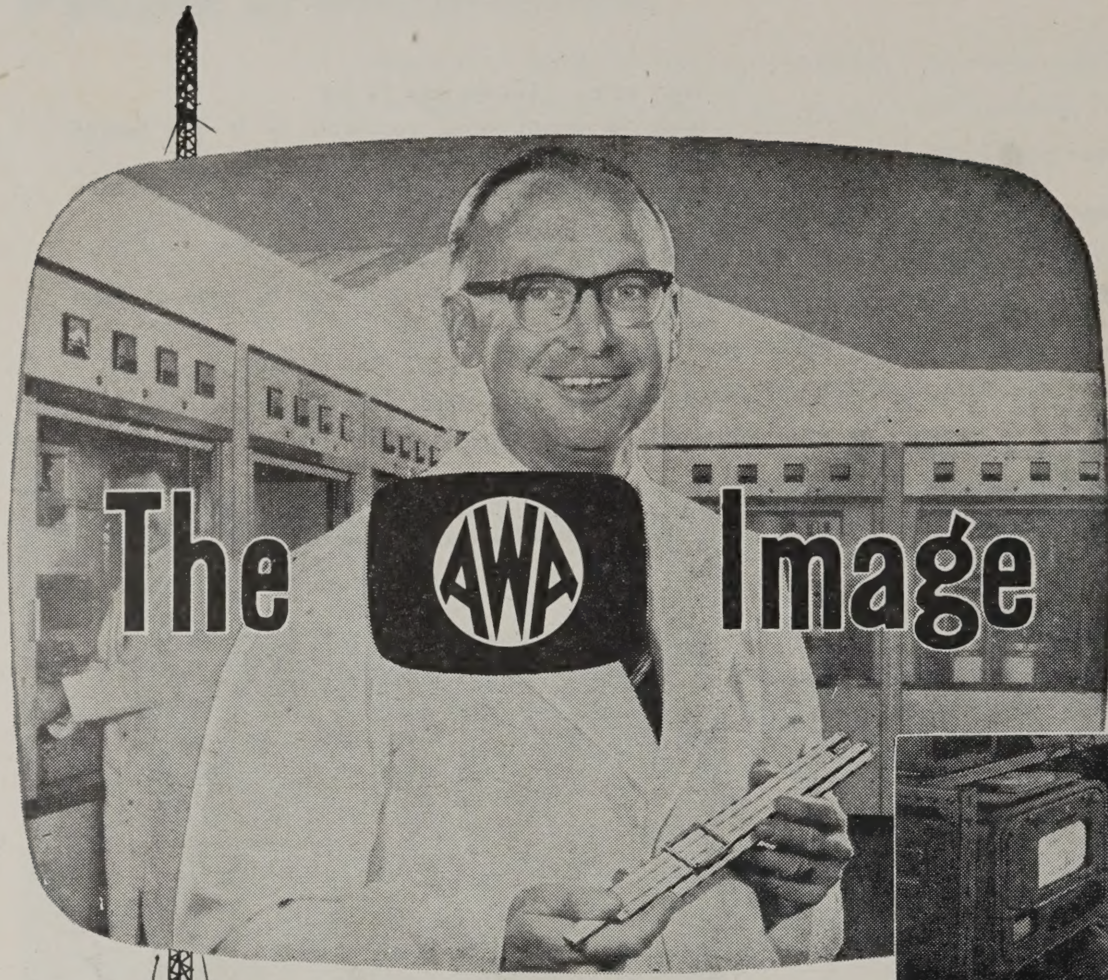
Fuses: A tubular fuse of 2A rating is wired in each leg of Sec. Maximum load current 1.4A.

Case: The Isolator is housed in a compact metal case and potted in a synthetic resin compound.

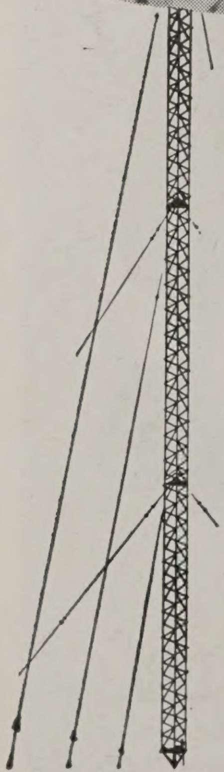
Manufactured and distributed by:

BEACON RADIO LTD.

Cnr. Brown and Fitzroy Streets, Ponsonby, Auckland, New Zealand.
P.O. Box 2757. Telephones: 14-704 and 13-390.



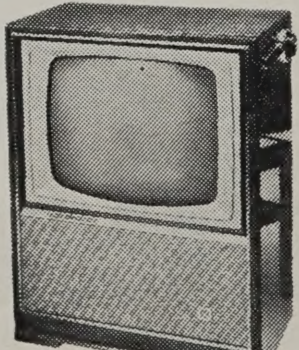
The AWA Image



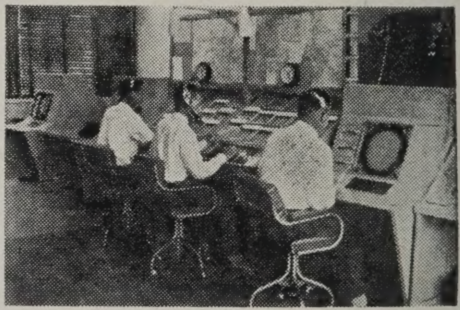
Behind this simple sign stand thousands of technicians, scientists and engineers, constantly engaged in the search for more efficient, simpler and better methods in the complex world of electronics. For nearly 50 years A.W.A. research and production has served New Zealand's needs at sea, on land and in the air. From the first equipment in broadcasting, to the latest in television, radar and x-ray, A.W.A. has proved its ability to contribute to the nation's security and progress.

AWA

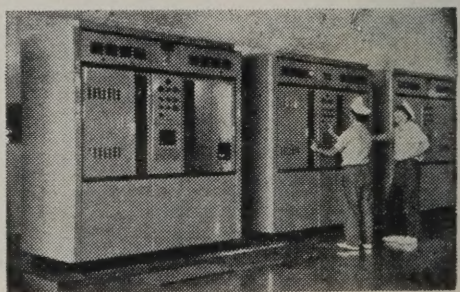
DESIGNS, MANUFACTURES AND GUARANTEES THE AWA DEEP IMAGE RADIOLA T/V RECEIVER.



A view of the Television Control Room of N.Z.B.S. Television Channel 2, Auckland.



Air Traffic Control Centre, Wellington, where the air ways are kept under careful surveillance aided by Marconi Radar Displays



Royal New Zealand Navy personnel running up A.W.A. CTH7 5 KW Communication Transmitters after installation.

AMALGAMATED WIRELESS (Australasia) N.Z. LIMITED

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A13.0